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The plant formations of the Nockamixon Rocks, Pennsylvania

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After the Delaware River is joined by the Lehigh River, it flows almost due south, but in a sinuous course for a distance of ten miles to a point a mile below Riegelsville, then it flows southeastward a mile and five-eighths to Kintnersville. At this place, it makes a sharp bend and flows directly eastward to Milford on the New Jersey side, or Black's Eddy on the Pennsylvania side. The south bank of the river rises between Kintnersville and Narrowsville into a series of precipitous cliffs known as the Nockamixon Rocks (FIGURE 1). More accurately, if the east sheet of the topographic map of Bucks and Montgomery counties (No. 12, Pennsylvania Geological Survey, Final Report) is consulted, these cliffs are found to be situated between 75° 6′ and 75° 10′ west longitude and 40° 34′ north latitude. The boldest rocks frown down on three miles of the river's bank (FIGURE 2). According to the Pennsylvania survey, the crest of the cliffs is 500 feet above the river. The cliffs form a sheer wall of rock in many places (FIGURE 3), cut by ravines down which the streams tumble in cascades, or waterfalls. An expert mountain-climber might ascend the precipitous rocks, but a less expert climber must clamber the ledges of rock from cascade to cascade in the several ravines that seam the rocks. As the streams that descend from above have an extremely limited watershed, they usually run dry during the summer months and little pools are left in the hollows of the water courses, where the wild birds are accustomed to drink.

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Rogers* fifty years ago described these cliffs as follows: "One stretch of precipice on the Pennsylvania side, known by the name of the Nockamixon Rocks is an exceedingly striking and picturesque range of beetling cliffs, rising sheer for 200 or 300 feet from the brink of the river with only a narrow roadway between them, through a length of nearly three miles. Some of the views from the base of these crags are almost grand; and the pictures they make with the river below are beautiful (FIGURE 2).

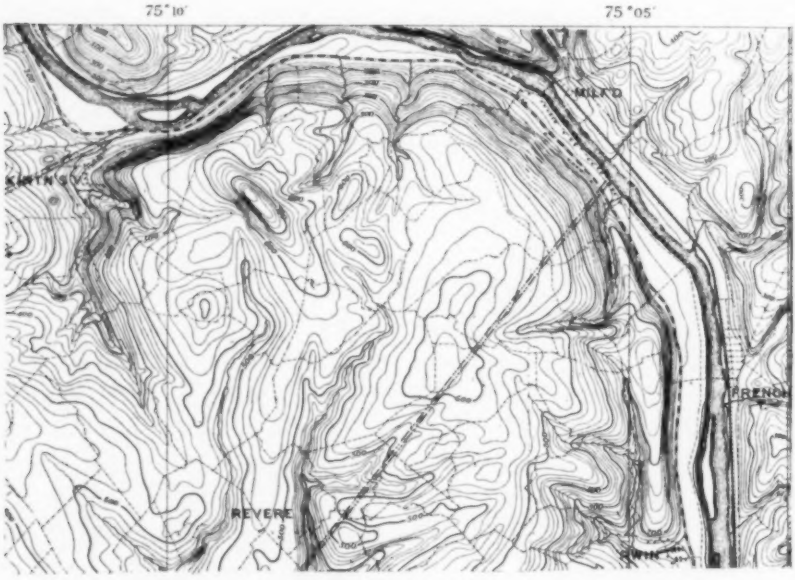

FIGURE 1. North part of Bucks County, Pennsylvania, north of Tohickon Creek, displaying the contour lines of the rock cliffs along the Delaware River, known as the Nockamixon Rocks. Between the 200-foot contour and canal lies the talus slope, between 200 feet and 400 feet, the precipices, while above 400 feet are the crest slopes Between Milford and Kintnersville lies the part surveyed botanically.

Tufts of bushes and trees and climbing vines heighten by their green hues the rich brown tints of the rocks, to the bold faces and narrow ledges of which they lend a grace which no cliffs without vegetation ever possess. There are few more attractive drives or walks by the river borders of Pennsylvania than the one at the foot of the Nockamixon Rocks." From the New Jersey side of

* Rogers, Henry D. The geology of Pennsylvania 1: 48. 1858.

the river, these rocks suggest the well-known Palisades of the Hudson River, but their color and origin are different, as they are composed of red shale. From this distance, the cliffs seem to be unbroken and higher than actual measurement indicates. The vegetation from the opposite bank of the river appears confined to the talus and the upper more gradual slopes near the crest of the cliffs. A nearer approach confirms the distant view, but in addition the botanist notes that every ledge, shelf, and crevice is occupied by trees, shrubs, and herbaceous plants which grow either in the bare rocky soil or where a poor soil has been formed by the disintegration of the rock masses (FIGURE 4). Viewed from the towpath of the canal at the base of the cliffs, the impression is that of a mixed deciduous forest with clumps of hemlocks, here and there, or a facies of the red cedar (*Juniperus virginiana*) to break the more even crown of the broad-leaved forest trees. Back of the cliffs the forest has been cleared and the nearly level surface is devoted to the cultivation of the ordinary farm crops. Beyond the fields to the south rises a group of rounded hills, ranging from 600 to 780 feet, the highest point being three quarters of a mile south of the edge of the rocks. A canal and a dirt road occupy the shore between the lower edge of the talus and the river bank (FIGURE 2). The talus, which is considerable at the west end, but almost absent in the middle and at the east end, consists of extremely loose broken pieces of the shale rock. It is difficult to climb over such material, because it constantly slides from beneath the feet. The mass of rock is a hard red slate, but the edges of the rock-shelves break off only too easily, as the climber finds out in attempting to ascend from shelf to shelf by his hands and knees (FIGURES 4 and 5). Care must be exercised not to lay hold of a piece that breaks away from the cliff. Numerous cracks appear in the rocks following the natural cleavage-planes, so that the rock soil and talus material is extremely porous, permitting the rapid percolation of the rain-water, which, when it first falls, makes the soil and rocks extremely slimy and slippery. Such a substratum upon which the characteristic plants of the locality are found growing is noted for its physiologic dryness, which is especially noteworthy in the summer, when little rain falls, and yet it is surprising what a large number of plants will grow and carry on their life proc-

esses to fruition in such an excessively dry soil. There must be considerable water in the rocky strata beneath, because here and there in the ravines in the driest summer weather, water is seen oozing out where the water-bearing seams are exposed. Various hepatic mosses, true mosses, and several other plants remain green in such spots, while many other plants of the drier cliff faces, having long since perfected their flowers and fruits, have dried up completely, all but their underground parts, which are reserved for perennation.

GEOLOGIC CHARACTER OF THE CLIFFS

The American New Red rocks extend across Bucks County into New Jersey. They are penetrated by eruptive dikes of trap rock which in our region form Haycock Mountain on the one hand and the celebrated Ringing Rocks on the other, while a crescent-

FIGURE 2. Nockamixon Rocks, Bucks County, Pa. General view of cliffs, canal, and Delaware River, looking east.

shaped mass just back of the edge of the cliff at the time of its appearance probably altered the original color and texture of the surrounding Mesozoic red shales. In the center of the horse-shoe shaped trap there is apparently a small trap hill on a higher

geologic horizon in the lower part of the Pottstown shales. The whole country hereabouts, elevated between 300 and 400 feet, is a table-land covered with trap rubbish and goes by the name of "the swamp" from the undrained condition of the soil, which is cold, wet, and unproductive. The whole series of New Red rocks comprises at least five subdivisions, beginning at the top, viz., the Pottstown; the Perkasie shales, 2000 feet thick; the Lansdale shales, 4700 feet; the Gwynedd shales, 3500 feet; and the Norristown shales, 6100 feet in thickness. The Nockamixon Rocks consist of shales of the second subdivision, viz., the Perkasie shales. These shales are comparatively hard, mostly green, dark red, or gray in color. Fossil traces of plants and animals occurring in these beds and mentioned by Professor Newberry, though few and imperfect, would seem to show that the shales are Jurassic.* The land underlaid by the Perkasie shales is generally less fertile than that of the neighboring red shales above (Pottstown) and below (Lansdale).

PLANT FORMATIONS OF THE CLIFFS

The vegetation of the cliffs may be considered conveniently as it covers the talus slope, the precipitous rock faces, the sides of the ravines, and the crest of the escarpment. As the contour lines of the map will show, the upper part of the cliffs slopes away from the edge of the precipice until the crest is reached. The vegetation of the talus is a part of that characteristic of the Piedmont Region and it therefore belongs to the

Deciduous Forest Formation

The constitution of this formation on the rocks depends upon the historic development of the flora which in all probability occupied the ground when the surrounding country was covered with a forest similar to that which now exists farther north in the Catskill and Adirondack mountains. So that the facies, as it exists here along the Delaware River, is a fragment or remnant of a more extensive forest which exists in a climate somewhat colder than that of the Bucks County of to-day. The tree and associated vegetation of the talus slopes is as follows (FIGURES 2, 3, 4, and 5):

* Lyman, Benjamin Smith. Report on the New Red of Bucks and Montgomery counties. Summary description of the geology of Pennsylvania. Final report Geological Survey of Penna. 3: 2589–2638. 1895.

TALUS VEGETATION

FACIES SPECIES: *Fagus americana* (*F. grandifolia*), *Acer Saccharum*, *Betula lenta*.

DOMINANT SPECIES: *Tilia americana*, *Ulmus americana*, *Quercus Prinus*, *Ulmus racemosa*, *Fraxinus americana*, *F. pubescens* (*F. pennsylvanica*), *Acer rubrum*, *Carpinus caroliniana*, *Ostrya virginiana*, *Juglans cinerea*, *J. nigra*.

UNCOMMON SPECIES: *Acer nigrum* (*A. Saccharum*, var. *nigrum*), *Morus rubra*, *Celtis occidentalis*, *Robinia Pseudo-acacia*.

GREGARIOUS SPECIES: *Tsuga canadensis*, *Juniperus virginiana*.

RARE SPECIES: *Betula nigra*, *Liriodendron Tulipifera*.

VERY RARE TREES: *Castanea dentata*, *Platanus occidentalis*. The absence of the white oak, *Quercus alba*, and the almost entire absence of the chestnut, *Castanea dentata*, and the tulip tree, *Liriodendron Tulipifera*, are noteworthy. The facies, consisting of beech, sugar maple, and cherry birch, suggests a similar one in the Catskill and Adirondack mountains, which I have denominated elsewhere * the beech-maple-birch facies.

SECONDARY TREE SPECIES (underwood): The secondary species of the talus are those which can grow under the leafy canopy of the dominant trees of the forest. Such are *Acer pennsylvanicum*, *Prunus americana*, *P. virginiana*, *P. serotina*, *Hamamelis virginiana*, and *Rhododendron maximum*, which occurs in association thickets.

SHRUBBY UNDERGROWTH (third layer = Niederwuchs): The species are arranged in the order of their prevalence, as follows: *Taxus canadensis*, *Hydrangea arborescens*, *Acer spicatum*, *Staphylea trifolia*, *Physocarpus opulifolius*, *Diervilla trifida* (*D. Lonicera*), *Viburnum acerifolium*, *Cornus circinata*, *C. paniculata*, *Rubus odoratus*, *R. occidentalis*, and *Sambucus racemosa*. The yew forms extensive matted growths on the rough talus slopes and is one of the most abundant of the plants which are found as an undergrowth in the forest. It occurs also on the upper cliff slopes near the crest. Here and there along the road at the edge of the forest are colonies of the staghorn sumach, *Rhus typhina*. It is hardly to be included as a component of the natural vegetation of

* Harshberger, John W. The plant formations of the Adirondack Mountains, Torreya **5**: 187–194. 1905. The plant formations of the Catskills, The Plant World **8**: 276–281. 1905.

the talus slope. The woody vines, or lianes, which form a part of the Deciduous Forest Formation may be enumerated in the order of their importance.

LIANES: *Ampelopis quinquefolia*, *Rhus radicans*, *Vitis Labrusca*, *V. aestivalis*, *V. cordifolia*, *V. vulpina*, *Celastrus scandens*, *Clematis virginiana*, *Menispermum canadense*, *Lonicera grata* (*L. Caprifolium*). Some of these ascend the rock faces, others reach the light by climbing the forest trees.

TREE MOSSES: The following mosses and hepatics, according to Lydia P. Borden, occur on the trunks and projecting roots of the forest trees. Near the base are found *Geocalyx graveolens*, *Lophocolea heterophylla*, *Dicranella heteromalla*, *Bryum roseum*, and, elsewhere, *Frullania eboracensis*, *Anomodon apiculatus*, *A. rostratus*, and *A. attenuatus*.

The forest floor is occupied by herbaceous plants which are commonly associated with the broad-leaved forest trees throughout the Piedmont Region. But it should be remarked here, that the numerical preponderance of certain of these herbs is to be accounted for by the peculiar habitat surroundings, as well as by the composition of the characteristic tree facies.

HERBACEOUS SPECIES (fourth, or ground layer): The classification of the herbaceous species of the forest is a difficult matter for several methods might be adopted according to the viewpoint of the observer. The following groups are adopted to arrange the herbs in the formation under consideration:

ABUNDANT FERNS: *Dryopteris marginalis*, *Polystichum acrostichoides*, *Adiantum pedatum*. Each of these ferns forms clumps on the forest floor. The first two species remain green during winter, while *Adiantum pedatum* is destroyed with the first sharp frost.

ROCK FERNS: *Polypodium vulgare* (abundant), *Cystopteris bulbifera* (not common), *Camptosorus rhizophyllus* (frequent on rock faces), *Asplenium Trichomanes*.

COMMON FERNS: *Asplenium ebeneum* (*A. platyneuron*), *Phegopteris hexagonoptera*, *Dennstaedtia punctilobula*, *Lycopodium clavatum*, *L. complanatum*, *Botrychium obliquum*, *B. virginianum*.

ABUNDANT HERBS: *Laportea canadensis*, *Impatiens fulva* (*I. biflora*), *Polygonatum biflorum*, *P. giganteum* (*P. commutatum*), *Smilacina racemosa*, *Asarum canadense*, *Mitella diphylla*, *Sangui-*

naria canadensis, Aquilegia canadensis (on the talus and on rocks), *Geranium Robertianum, Viola canadensis, Cimicifuga racemosa.*

SECONDARY HERBS: *Trillium erectum, T. cernuum, Thalictrum purpurascens, T. dioicum, T. polygamum, Hydrophyllum canadense, H. virginicum, Eupatorium ageratoides* (*E. urticaefolium*), *Parietaria pennsylvanica, Aralia racemosa, A. trifolia, Osmorrhiza brevistylis, Zizia cordata, Thaspium aureum, Cryptotaenia canadensis, Viola striata, V. blanda, V. cucullata, V. palmata, Galium Aparine, G. triflorum, Helianthus decapetalus, Aster cordifolius, Cerastium arvense* var. *oblongifolium, Actaea alba.*

WINTERGREEN SPECIES: On October 23, 1908, the writer observed the following species of the talus slopes which are the most important elements of the wintergreen flora: *Taxus canadensis, Asarum canadense, Geranium Robertianum* (in flower), *Carex platyphylla, Saxifraga pennsylvanica, Dryopteris marginalis, Polystichum acrostichoides, Polypodium vulgare, Tsuga canadensis*, and *Rhododendron maximum*, which the writer has shown elsewhere takes advantage of every mild, sunny day during the winter to manufacture starch and other organic products.

TALUS AND CLIFF ROCK MOSSES: The mosses and hepatics that grow on the talus and cliff rocks are: (Hepaticae), *Conocephalum conicum, Marchantia polymorpha, Pellia epiphylla, Geocalyx graveolens, Lophocolea heterophylla, Plagiochila asplenioides, Porella platyphylla, Scapania nemorosa;* and (Musci) *Catharinea angustata, C. undulata, Pogonatum brevicaule, Polytrichum commune, Webera sessilis, Fissidens osmundioides, F. bryoides* (wet and damp places), *Ceratodon purpureus, Dicranella heteromalla, D. h. Fitzgeraldi, D. scoparium, Ditrichum tortile, D. pallidum, Leucobryum glaucum, Weisia viridula, Funaria hygrometrica, Aulacomnium heterostichum, Bartramia pomiformis, Bryum argenteum, B. caespiticium, B. roseum, Mnium affine, M. punctatum, M. rostratum, M. sylvaticum, Anomodon apiculatus, A. rostratus, A. attenuatus, Thuidium delicatulum, Cirriphyllum Boscii, Hylocomium proliferum, H. triquetrum, Climacium americanum*, and *C. dendroides.*

The following list of additional plants arranged by families was furnished me by Dr. S. P. Seese, of Lansdale, Pennsylvania. All of them grow on the talus slopes of the Nockamixon Rocks.

Arisaema triphyllum,
" *Dracontium*,
Medeola virginiana,
Erythronium americanum,
Oakesia sessilifolia,
Uvularia perfoliata,
Allium tricoccum,
Liparis liliifolia (rare),
Orchis spectabilis,
Habenaria lacera,
Cypripedium pubescens,
Aristolochia Serpentaria,
Claytonia virginica,
Anemone nemorosa,
Hepatica triloba,
Anemonella thalictroides,
Hydrastis canadensis (now extinct),
Podophyllum peltatum,
Caulophyllum thalictroides,
Dicentra Cucullaria,
" *canadensis* (present years ago),
Corydalis glauca,
" *aurea*,
Dentaria laciniata,
" *diphylla*,
Arabis laevigata,
" *perfoliata* (*A. glabra*),
canadensis,
Gillenia trifoliata,
Vicia americana,
Amphicarpa monoica,
Epilobium coloratum,
Circaea lutetiana,
Sanicula marilandica,
Thaspium barbinode,
Pyrola rotundifolia,
Monotropa uniflora,
Gentiana quinquefolia,
Obolaria virginica,
Asclepias tuberosa,
" *purpurascens*,
" *phytolaccoides*,
Polemonium coeruleum (*P. Van Bruntiae*),
Cynoglossum officinale,
Mertensia virginica,
Myosotis palustris (*M. scorpioides*),
Lophanthus nepetoides,
Teucrium canadense,
Scutellaria lateriflora,
" *pilosa*,
Pentstemon laevigatus var. *digitalis*,
Pedicularis canadensis
Epiphegus virginiana
Veronica virginica,
" *scutellata*,
" *officinalis*,
" *serpyllifolia*,
" *peregrina*,
Triosteum perfoliatum,
Mitchella repens,
Galium circaezans,
Campanula americana,
Lobelia spicata,
" *inflata*,
Aster oblongifolius,
" *Novae-Angliae*,
" *laevis*,
" *vimineus*,
Erigeron bellidifolius (*E. pulchellus*),
" *philadelphicus*,
Eupatorium purpureum,
Helianthus decapetalus,
Solidago speciosa,
" *nemoralis*.

RAVINE VEGETATION

The trees and shrubs which extend into the ravines are essentially broad-leaved species which form a constituent part of the

Deciduous Forest Formation. The composition of the vegetation of the ravines is somewhat different from that of the talus slope, indeed, the dominant trees found in the glens are so associated as to form a distinct facies of the formation. As the flora of the ravines differs somewhat in each case, it will be considered with reference to the particular gully in which it occurs. The most characteristic ravine is one which cuts back into the middle portion of the cliffs. A stream cascades over precipitous rocks covered with mosses and liverworts, among them *Marchantia polymorpha*. The tree vegetation is as follows:

FACIES: *Tilia americana, Ulmus americana.*

DOMINANT ASSOCIATED SPECIES: *Quercus Prinus, Acer Saccharum, Ostrya virginiana.*

SHRUBBY UNDERGROWTH (Niederwuchs): *Taxus canadensis* (covering slopes extensively), *Hydrangea arborescens, Physocarpus opulifolius, Rubus odoratus, Celastrus scandens.*

HERBS OF FOREST FLOOR: The soil of the ravine slopes is utilized in the growth of *Asarum canadense, Impatiens fulva* (*I. biflora*), *Chelone glabra, Solidago flexicaulis* (*S. latifolia*), *Eupatorium ageratoides* (*E. urticaefolium*).

ROCK HERBS: The characteristic rock flora of these ravines includes *Aquilegia canadensis, Campanula rotundifolia, Arabis lyrata, Geranium Robertianum, Heuchera americana, Cerastium arvense* var. *oblongifolium, Saxifraga pennsylvanica, Lonicera grata* (*L. Caprifolium*), *Agrostis scabra* (*A. hyemalis*), *Polypodium vulgare, Camptosorus rhizophyllus, Celastrus scandens, Salix cordata, Physocarpus opulifolius.*

The most western ravine is filled with such an association of trees that a new facies may be said to exist.

FACIES: *Acer Saccharum, Fagus americana, Tsuga canadensis.* These trees comprise the maple-beach-hemlock facies.

ASSOCIATED TREES: Here grow in association such dominant trees as *Tilia americana, Betula lenta, Quercus Prinus, Morus rubra*, and *Acer rubrum*. The hemlock, *Tsuga canadensis*, is not sufficiently abundant to constitute a formation, but it is mixed with the broad-leaved trees in such proportion as to necessitate its inclusion in the deciduous forest proper. Associated with these trees as an *undergrowth* are found *Taxus canadensis* (abundant), *Hydran-*

gea arborescens, *Rhododendron maximum* (in thickets), *Viburnum acerifolium*, and the Virginia creeper, *Ampelopsis quinquefolia*.

SHADE HERBS: The herbs that grow in the dense shade are *Pilea pumila*, *Laportea canadensis*, *Hepatica triloba*, *Thalictum purpurascens* (*T. revolutum*), *Mitella diphylla*, *Smilacina racemosa*, *Maianthemum canadense*, *Impatiens fulva* (*I. biflora*), and *Adiantum pedatum*, which occupies the outcropping rock masses. As this ravine is ascended, the woods become drier and the hill slopes more gradual and the ravine vegetation fuses with that of the crest.

The valley back of the Narrowsville Hotel is characterized by a stream the flat banks of which show the presence of *Juglans cinerea*, *Fraxinus americana*, *Carpinus caroliniana*, *Betula lenta*, *Tilia americana*, *Liriodendron Tulipifera* (sparingly), and such shrubs as *Amelanchier canadensis*, *Lindera Benzoin* (*Benzoin aestivale*), *Hydrangea arborescens*, and *Rubus occidentalis*. On the slopes above a small waterfall are assembled *Dryopteris marginalis*, *Polystichum acrostichoides*, *Asarum canadense*, *Aquilegia canadensis*, *Impatiens fulva* (*I. biflora*), while on the steep rocks overhanging the stream are found the walking fern, *Camptosorus rhizophyllus* and the columbine, *Aquilegia canadensis*.

In the bottom of another ravine, the forest consists of such trees as *Acer Saccharum*, *Fagus americana* (*F. grandifolia*), *Quercus coccinea*, and, sparingly, *Liriodendron Tulipifera*. The shrubs are *Hamamelis virginiana*, *Corylus americana*, *Hydrangea arborescens*, *Rubus odoratus*, *Lindera Benzoin* (*Benzoin aestivalis*), *Sambucus racemosa*, and *Viburnum acerifolium*. The yew, *Taxus canadensis*, forms extensive masses, as elsewhere on the cliffs, while the marginal shield fern occurs in extensive patches. The forest floor is occupied by a covering of quite a few characteristic herbaceous plants, such as *Sanguinaria canadensis*, *Smilacina racemosa*, *Arisaema triphyllum*, *Asarum virginicum*, *Adiantum pedatum*, *Botrychium virginianum*, and on the rocks dripping with water occur the moss *Eurynchium hians* and the liverwort *Marchantia polymorpha*. Lower down, where the stream breaks over a rock face about 15 feet high, the ravine narrows and the hemlock, *Tsuga canadensis*, becomes more abundant, associated with *Betula lenta* and *Acer Saccharum* to form a facies (the maple-birch-hemlock facies), including *Quercus rubra*, *Rhododendron maximum*, *Corylus americana*, *Hy-*

drangea arborescens, *Acer spicatum*, *Taxus canadensis*, and the jewel weed, *Impatiens fulva*, together with the ferns, *Polystichum acrostichoides* and *Polypodium vulgare*, which adorn the tops of the projecting slate rocks. *Ampelopsis quinquefolia* drapes the mossy rocks of the ravine. The distribution of the mosses on the rocks is determined by the places where in midsummer the last water is found, in small trickling streams affording sufficient moisture to keep the mosses alive, while the rock-faces, where the stream, when full, falls over the slopes, are practically without any mossy covering.

RAVINE ROCK MOSSES: The mosses and hepatics found on the rocks of the ravines, according to Lydia P. Borden, are: (Hepaticae) *Marchantia polymorpha*, *Conocephalum conicum*, *Pellia epiphylla*, *Metzgeria conjugata*, *Cephalozia curvifolia*, *Lophocolea heterophylla*, *Geocalyx graveolens*, *Odontoschisma prostratum*, *Scapania nemorosa*, *Plagiochila porelloides*, *P. asplenioides*, *Porella platyphylla*; and (Musci), *Catharinea undulata*, *Fissidens bryoides*, *Dicranella heteromalla*, *Funaria hygrometrica*, *Aulacomnium palustre*, *Philonotis fontana* (wet rocks), *Bryum argenteum*, *B. roseum*, *B. caespiticium*, *Mnium sylvaticum*, *M. punctatum*, *Anomodon apiculatus*, *A. rostratus*, *A. attenuatus*, *Thuidium delicatulum*, *Climacium americanum*, *C. dendroides*, *Cirriphyllum Boscii*, and *Plagiothecium denticulatum*.

In addition to the species mentioned in the above description, the ravine flora includes, according to Dr. S. P. Seese, of Lansdale, Pennsylvania:

Osmunda regalis,
" *cinnamomea*,
Asplenium Filix-foemina,
Dryopteris noveboracensis,
" *spinulosa*,
" *spinulosa* var. *intermedia*,
" *simulata*,
Corallorhiza odontorhiza,
Goodyera pubescens,
Adlumia cirrhosa (*A. fungosa*),
Cercis canadensis,
Cornus alternifolia,
Kalmia latifolia,
" *angustifolia*,
Senecio obovatus,
Nabalus altissimus.

SUMMIT-SLOPE AND CLIFF-CREST VEGETATION

Ascending the hills back of the Narrowsville Hotel, the botanist encounters a forest which covers the slopes up to the

crest of the hill. Here the woods consist of such trees as *Quercus Prinus*, *Q. coccinea*, *Q. rubra*, *Q. alba* (rare), *Fagus americana* (*F. grandifolia*), *Tsuga canadensis*, *Acer rubrum*, *Betula lenta*, *Carya porcina* (*Hicoria glabra*), *Hamamelis virginiana*, and *Viburnum dentatum*, and in dry rocky situations a facies is formed of red cedar, *Juniperus virginiana*. The woody vines of these woods are *Ampelopsis quinquefolia*, *Rhus radicans*, *Vitis Labrusca*, and *Celastrus scandens*. *Ceanothus americanus*, the New Jersey tea, forms pure associations in open places well lighted by the sun.

FIGURE 3. Talus slopes, precipitous rocks, and summit slopes showing the Deciduous Forest Formation.

Reaching the head of a large ravine, the character of the woods changes somewhat, merging into the cliff-crest vegetation. Prominent in this transition forest are *Quercus Prinus*, *Castanea dentata* (the only place where the chestnut is prominent), *Quercus rubra*, *Acer Saccharum*, and as secondary species, *Hamamelis virginiana*, *Viburnum acerifolium*, and the herb *Cunila Mariana* (*C. origanoides*). This is a forest growth which connects the facies of the

talus slope with the tree growth and other vegetation, which typically covers the crest slopes above the precipitous rocks below. All along the cliffs just back of the crest slope are cultivated fields where the gullies cut back into the tableland, so that the crest flora forms a narrow fringe which is continuous with the slopes that gradually dip to the precipices below. The soil of these slopes (FIGURES 3 and 5) is edaphically dry and the tree vegetation is conditioned largely by the character of the underlying substratum.

FACIES: The steeper slopes where the crest flora is most typically developed are occupied by *Quercus Prinus* (the most abundant tree), *Ulmus americana*, *Ostrya virginiana*, *Acer Saccharum*, *Quercus rubra*, *Rhododendron maximum* (on the steepest slopes).

The rocks which jut out beyond the general crest (FIGURE 5) and from which the escarpment falls abruptly to the river below are tenanted by such trees as *Quercus rubra*, *Q. tinctoria* (*Q. velutina*), *Q. Prinus*, *Ostrya virginiana*, *Betula lenta*, *Cornus florida*, and at the extreme edge are found wind-tossed forms of the red cedar, *Juniperus virginiana*. Perhaps such vegetation should be included as a part of the Rock-Cliff Formation, later to be described. Before considering that formation it should be mentioned that at one point the soil of the tableland is too barren for profitable cultivation of agricultural crops, although the attempt was made years ago to till these barren fields. The abandoned fields are grown up to *Pinus rigida* and *Juniperus virginiana*, dotted over in an open formation (park-like); associated with *Ceanothus americanus* and *Rhus typhina*, together with various weeds.

DOMINANT TREE SPECIES: *Tilia americana*, *Acer rubrum*, *Carya alba* (*Hicoria ovata*), *Nyssa sylvatica*, *Sassafras officinalis*, *Prunus serotina*, *Fraxinus americana*, *Castanea dentata* (rare), *Pinus Strobus* (rare), and *Populus grandidentata*.

SECONDARY UNDERGROWTH SPECIES: The brinks of the precipices (FIGURE 3) show masses of the yew, *Taxus canadensis*, together with *Diervilla trifida* (*D. Lonicera*), *Gaylusaccia frondosa*, *G. resinosa* (*G. baccata*), *Ribes rubrum*, *R. rotundifolium*, *Physocarpus opulifolius*, and *Lonicera grata* (*L. Caprifolium*). In addition the crest is occupied by *Amelanchier canadensis*, *Hamamelis virginiana*, *Staphylea trifolia*, *Viburnum dentatum*, *V. pubescens*, and *Celastrus scandens*.

LIANES: The trees are festooned with such vines as *Vitis cordifolia*, *V. Labrusca*, *Clematis virginiana*, *Smilax rotundifolia*, and *Menispermum canadense*.

HERBACEOUS CREST SPECIES: The ground under the above-mentioned trees and shrubs is covered by *Impatiens fulva* (*I. biflora*), *Smilacina racemosa*, *Arisaema triphyllum*, and *Sedum Telephium* (*S. purpureum*), which retains its green color as late as November, and in addition the botanist finds the plants in the list below.

FIGURE 4. Details of Rock Cliff Plant Formation with the Deciduous Forest Formation to the right, covering the talus slopes.

CREST ROCK MOSSES: According to Lydia P. Borden, the crest rocks are characterized by *Catharinea angustata*, *Polytrichum commune*, *P. piliferum*, *Leucobryum glaucum*, *Weisia viridula*, *Funaria hygrometrica*, *Bryum roseum*, *Mnium sylvaticum*, *Cirriphyllum Boscii*, *Climacium americanum*, and *C. dendroides*.

LIST OF ADDITIONAL CREST HERBS (furnished by Dr. S. P. Seese)

Selaginella rupestris,
Smilax herbacea,
Lilium philadelphicum,
Hypoxis erecta,
Spiranthes gracilis,
" *cernua*,

Comandra umbellata,
Polygonum tenue,
Silene stellata,
Anemone virginiana,
Arabis canadensis,
Spiraea salicifolia,
Fragaria virginiana,
" *vesca*,
Apios tuberosa,
Baptisia tinctoria,
Tephrosia virginiana,
Oxalis violacea,
" *stricta*,
Linum virginianum,
Polygala sanguinea,
" *verticillata*,
Acalypha virginica,
Hypericum ellipticum,
Lechea major (*L. villosa*),
" *minor*,
Viola sagittata,
" *pubescens*,
" *fimbriatula*,
" *scabriuscula*,
Cuphea viscosissima (*C. petiolata*),
Ipomoea Quamoclit,
" *pandurata*,
Pimpinella Saxifraga,
Lithospermum arvense,
Trichostema dichotomum,
Cunila Mariana (*C. origanoides*),
Pycnanthemum lanceolatum,
Hedeoma pulegioides,
Monarda fistulosa,
" *punctata*,
Gerardia flava,
Melampyrum americanum,
Sicyos angulatus,
Aster corymbosus (*A. divaricatus*),
Aster macrophyllus,
" *patens*,
" *cordifolius*,
" *sagittifolius*,
" *multiflorus*,
" *prenanthoides*,
Eupatorium ageratoides (*E. urticaefolium*),
Helianthus divaricatus,
" *strumosus*,
Hieracium canadense,
" *paniculatum*,
" *scabrum*,
" *venosum*,
Sericocarpus conyzoides (*S. asteroides*),
Solidago bicolor,
" *caesia*,
" *latifolia*,
" *rugosa*.

The following additional species, not allocated to any of the various habitats previously mentioned, are characteristic of the dry woods, Nockamixon Rocks, according to Dr. Seese, who has botanized here over forty years:

Anychia dichotoma (*A. polygonoides*),
Geum album
" *virginianum*,
Agrimonia Eupatoria (*A. gryposepala*),
" *parviflora*,
Desmodium nudiflorum,
Desmodium acuminatum (*D. grandiflorum*),
" *canescens*,
" *viridiflorum*,
Lespedeza procumbens,
" *capitata*,
" *Nuttallii*,
" *violacea*.

FIGURE 5. Top Rock, Delaware Narrows, showing Deciduous Forest Formation of the talus slopes, the Rock-cliff Plant Formation and the xerophytic deciduous forest covering the almost bare rocks of the summit.

Rock-cliff Formation

The escarpment is precipitous in most places along the entire front of the Nockamixon Rocks (FIGURES 2, 3, 4, and 5). Some of the cliffs rise as a sheer wall for a distance of 300 feet above the country road at their base. The face of the precipice is irregular owing to the numerous clefts, pockets and shelves, or platforms which are found at various elevations and in various positions and exposures (FIGURES 4 and 5). The pockets are formed by the falling of masses of rock. The shelves are flat ledges running along the face of the precipice (FIGURE 5). One such shelf runs at least two thousand feet in an upward sloping direction toward the west. In places, it is ten feet wide, in other places it narrows down to a width of one or two feet. The smaller ledges are occupied by grasses and other herbaceous plants, while the larger projecting flats accommodate various trees, shrubs, and lianes which climb up the vertical rock surfaces.

VEGETATION OF LARGER ROCK SHELVES: The vegetation of the long shelf just mentioned consists of such trees as *Ostrya virginiana*, *Celtis occidentalis*, *Ulmus americana*, *Acer Saccharum*, *Juniperus virginiana* (abundant), *Juglans cinerea*, *Quercus rubra*, *Prunus virginiana*, *Hamamelis virginiana*, *Tilia americana*, and *Prunus serotina*, while the most characteristic shrub is *Physocarpus opulifolius*. Other shrubs are associated with the trees and the nine-bark, viz., *Rubus occidentalis* (in sunny exposures), *Rubus odoratus*, *Taxus canadensis* (in dense masses), *Staphylea trifolia*, *Sambucus racemosa*, and on small rock shelves, *Lonicera grata* (*L. Caprifolium*). In the shade of the trees grow clumps of *Dryopteris marginalis*, *Impatiens fulva* (*I. biflora*), *Smilacina racemosa*, *Hepatica triloba*, and *Aquilegia canadensis*. The unshaded rock exposures are characterized by *Pentstemon hirsutus* (*P. pubescens*), *Heuchera americana*, *Achillea Millefolium*, *Linaria vulgaris*, *Verbascum Thapsus*, *Cerastium arvense* var. *oblongifolium*, *Aquilegia canadensis*, *Geranium Robertianum*, *Saxifraga virginiensis*, and *Nepeta Cataria*.

West of the main outlook, the rocks present a series of easily descended, serially arranged shelves (FIGURE 5), each occupied by an association of plants. *Phlox subulata* grows in masses on the bare shale rock, while the broad rock shelves here are occupied

by *Amelanchier canadensis*, *Rubus canadensis*, *R. hispidus*, *R. strigosus*, *Rhus typhina*, *Fraxinus pubescens*, *Populus grandidentata* (rare), *Betula lenta*, *Ostrya virginiana*, *Aster cordifolius*, *Baptisia tinctoria*, and *Sedum Telephium* (*S. purpureum*). The lianes begin their growth on a shelf, or in a rock pocket and ascend the cliffs, as if directed on a trellis. Such are *Ampelopsis quinquefolia*, *Vitis cordifolia*, and *Rhus radicans*. Near the top of the cliffs on some shelves (FIGURE 5) sheltered by the overhanging rocks and associated with *Campanula rotundifolia*, *Anemone pennsylvanica*, *Chelone glabra*, *Steironema ciliatum*, *Salix cordata*, *Physocarpus opulifolius*, *Maianthemum canadense*, *Polypodium vulgare*, and *Geranium Robertianum*, grows the most unique plant of the Nockamixon Rocks, viz., *Sedum Rhodiola* (*S. roseum*). This plant, which grows on the bare shale rock, is anchored by thick, succulent, coral-like, branching rhizomes, which give rise in summer to the grayish green leaves and small yellowish green flowers. Each season the leaves fall from the plant, and the bare rhizomes, with the additional annual growth, perennate until the next growing season. The writer measured one plant with a rhizome six inches long and with roots that penetrated the rock crevices over two feet. This plant is perhaps most abundant beneath the shelving rocks at the head of one of the ravines, which is kept cool by the currents of air which strike the rocks in such a direction as to be deflected into the rocky amphitheater at the head of the glen, where the roseroot grows so abundantly. On several hot days last summer, the temperature was perceptibly lower in the shadow of the beetling cliffs, fanned by the breezes, which blew into the glen from the north. In all probability, *Sedum Rhodiola* (*S. roseum*) is a relict of the time when the climate was much colder than now — a time characterized by the retreat of the glacial ice sheets that covered the headwaters of the Delaware River. The present distribution of the plant supports this view, because it occurs in Greenland and Labrador, on the high alpine peaks from Alberta and Alaska to Colorado and California (altitude 9,000–14,000 feet), also along the coast to rocky islands and cliffs in eastern Maine * and locally at Chittenango Falls, New York, on the high cliff off Port Jervis, Wayne County, Pennsylvania, and the

* Cushman, Joseph A. Some interesting Maine plants. Rhodora 11 : 12. 1909.

Nockamixon Rocks, Pennsylvania. Its preservation on the Nockamixon cliffs is probably due to two factors, viz., the coolness of the habitat under the rocks at the head of the glen with a northern exposure and the isolation or inaccessibility of the shelves upon which the plant grows.

VEGETATION OF THE SMALLER ROCK SHELVES: The vegetation of the smaller rock shelves varies (FIGURE 4). One shelf is occupied by *Cerastium arvense* var. *oblongifolium*, another by *Geranium Robertianum*, another is fringed with a grass, *Muhlenbergia tenuiflora* (*M. Willdenowii*). Still other shelves are characterized by *Poa debilis*, *Oryzopsis melanocarpa* (*O. racemosa*), *Anemone virginiana*, *Potentilla canadensis*, *Heuchera americana*, *Saxifraga virginiensis*, *Galium boreale*, *Solidago caesia*, while *Physocarpus opulifolius* and *Juniperus virginiana* are found occasionally on the cliff face in rock pockets.*

PLANTS OF THE CREVICES AND ROCK POCKETS: The characteristic plants of the rock crevices and smallest rock depressions (FIGURE 4), apparently growing out of the precipice itself, are: *Dryopteris marginalis*, *Asplenium Trichomanes*, *Polypodium vulgare*, *Cystopteris fragilis*, *Woodsia ilvensis*, *W. obtusa*, *Aquilegia canadensis*, *Cerastium arvense* var. *oblongifolium*, *Arabis lyrata*, *A. laevigata*, *Geranium Robertianum*, *Heuchera americana*, *Verbascum Thapsus*, and *Campanula rotundifolia*. The species seize every vantage ground and it is surprising to find how their roots can penetrate and hold fast to a narrow crack, or fissure, in the face of the smooth rock faces.

WEED VEGETATION

NATIVE MIGRANTS: The native plants which have left their original habitats and have spread along the roadside form an element of the vegetation which illustrates what species have adapted themselves to the new environmental conditions. The species of composite plants owe their spread to the light fruits which are wind-distributed.

* The writer wishes to state with reference to the identification of the plants mentioned in this and other of his phyto-geographic papers that the following plan is pursued. If he feels no doubt as to the identity of the plant, it is noted in the field notebook; if he is in doubt, a specimen is collected, tagged, and identified at field headquarters by means of some manual · and, if unable after such study to name the plant, a specimen is dried for more careful study with herbarium material at hand.

Cystopteris fragilis,
Tradescantia virginiana,
Commelina nudiflora (*C. communis*),
Euphorbia maculata,
" *Preslii*,
" *hirsuta*,
Crotalaria sagittalis,
Cassia marilandica,
" *Chamaecrista*,
" *nictitans*,
Lysimachia quadrifolia,
" *Nummularia*,
Castilleja coccinea,
Nepeta Glechoma (*N. hederacea*),
Leonurus Cardiaca,
Lamium maculatum,
Aster multiflorus,
" *dumosus*,
Eclipta alba,
Helenium autumnale,
Mikania scandens,
Solidago lanceolata (*S. graminifolia*),

INVADING WEED SPECIES: The original formations have been disturbed but little by the invasion of weed species, because the original vegetation has remained in possession of the rocks and talus slopes and, therefore, the formations are closed ones in the phytogeographic sense. The following species of foreign introduction are elements which might strongly alter the existing formations, if not held in check by the native vegetation. However, it is important to recognize this element and enumerate the species belonging to it. The species in small capitals were introduced by the early Pennsylvania German settlers, who cultivated them.

Urtica dioica,
HUMULUS LUPULUS
Rumex crispus,
" *obtusifolius*,
" *Acetosella*,
Polygonum orientale,
" *Persicaria*,
FAGOPYRUM ESCULENTUM,
Chenopodium album,
" *Botrys*,
Amaranthus retroflexus,
Phytolacca decandra,
Mollugo verticillata,
Dianthus Armeria,
" BARBATUS (established for years),
Saponaria officinalis,
Lychnis vespertina (*L. alba*),
Agrostemma Githago,
Stellaria media,
Cerastium vulgatum,
Portulaca oleracea,
Ranunculus bulbosus,
Helleborus niger (escaped),
Sisymbrium officinale,
Brassica nigra,
Capsella Bursa-pastoris,
Lepidium campestre,
Potentilla norvegica,
Trifolium arvense,
" PRATENSE,
" REPENS,
" *procumbens*,
" *agrarium*,
" INCARNATUM,
Melilotus alba,
" *officinalis*,
Medicago sativa,
LINUM USITATISSIMUM,
Malva rotundifolia,

Malva sylvestris,
Sida spinosa,
Hibiscus Trionum,
Abutilon Avicennae (*A. Theophrasti*),
Hypericum perforatum,
Daucus Carota,
PASTINACA SATIVA,
FOENICULUM OFFICINALE,
Echium vulgare,
Brunella vulgaris,
Lamium amplexicaule,
" *maculatum*,
Nepeta Cataria,
" *Glechoma* (*N. hederacea*),
MENTHA ROTUNDIFOLIA,
" *viridis* (*M. spicata*),
" *piperita*,
Verbena urticifolia,
" *hastata*,
Solanum Dulcamara,
Datura Stramonium,
Convolvulus arvensis,
Plantago lanceolata,
Valerianella olitoria (*V. Locusta*),
Dipsacus sylvestris,
Achillea Millefolium,
Anthemis Cotula,
" *arvensis*,
Arctium Lappa,
ARTEMISIA ABSINTHIUM (pretty well established),
Cirsium lanceolatum,
" *arvense*,
Chrysanthemum Leucanthemum,
" *Parthenium* (established),
Galinsoga parviflora,
TANACETUM VULGARE,
Taraxacum officinale.*

HISTORIC SKETCH

The Nockamixon Rocks have been visited by a number of local botanists, who have spent a day or two in the study of its interesting flora. Nothing has been published on this flora except a short note by E. Newlin Williams, entitled "Botanizing in the Delaware Narrows" which appeared in Meehan's Monthly, March, 1897, pages 43 and 44. The flora of the Rocks was first carefully studied by Professor Thomas C. Porter of Lafayette College, Easton, Pa. He was followed by Professor J. T. Rothrock, Dr. S. P. Seese, Dr. J. Bernard Brinton, Mr. Stewardson Brown, Dr. C. D. Fretz, who notes some of the Nockamixon plants in his "Flora of Bucks County," and by Dr. N. L. Britton. The Torrey Botanical Club and the Philadelphia Botanical Club made a joint excursion to the place on May 30, 1893, under the leadership of Professor Thomas C. Porter. The Botanical Society of Pennsylvania botanized here on Decoration Day, May 30, 1908, under the guidance of Dr. Samuel P. Seese of Lansdale, Pa. The writer has made three successive trips to the Narrows, viz., on May, 30, 1908, June 30, 1908 and October 23, 1908, several

* Dr. S. P. Seese, of Lansdale, Pennsylvania, is authority for this list.

days being spent during June and early July in the collection of plants and in a study of the flora. Collections of Nockamixon plants repose in the herbaria of Lafayette College, Easton, Pennsylvania, of the Academy of Natural Sciences of Philadelphia, of the New York Botanical Garden, and of the University of Pennsylvania.

UNIVERSITY OF PENNSYLVANIA,
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Studies on the Rocky Mountain flora — XX

Per Axel Rydberg

Phacelia nervosa sp. nov.

Phacelia alpina Rydb. Fl. Colo. 283, in part, as to the Colorado specimens. 1906.

Perennial, with a short rootstock; stems decumbent at the base, 1–3 dm. high, more or less hirsute and with short grayish hairs intermixed; lower leaves with petioles 2–7 cm. long, simple or with a pair of smaller lobes on the petioles; blades lanceolate, 2–5 cm. long, acute, hirsute on both sides, veins rather strong beneath; upper leaves subsessile; inflorescence soon open; the racemes peduncled, in fruit 4–9 cm. long; calyx more or less tinged with purple, about as long as the corolla; sepals narrowly linear, acute, hirsute, with a strong midrib; corolla white or nearly so, pubescent, about 5 mm. long; filaments about twice as long as the corolla, slightly bearded at the base with short hairs; seeds lance-ovoid, 2.5 mm. long, brown, faveolate.

This was mistaken for *Phacelia alpina*, which it resembles in habit, but it differs in the longer and more open racemes, the longer calyx-lobes, which about equal the corolla and have a strong midrib, in the almost glabrous filaments, in the whitish instead of lilac corolla, and in the more acute seeds. It grows on high mountains at an altitude of 3000 m. or more.

Colorado: Silver Plume, Aug. 24, 1895, *P. A. Rydberg* (type, in herb. N. Y. Bot. Gard.); same locality and date, *C. L. Shear 3253;* Mt. Harvard, Aug. 17, 1896, *C. L. Shear 3790;* 1896, *F. E. Clements 408;* near Ironton, San Juan County, July, 1899, *C. C. Curtis.*

Phacelia Burkei sp. nov.

Perennial, with a taproot; stems 2–3 dm. high, canescent; basal leaves 3–10 cm. long, petioled; blades lanceolate, entire, strongly veined, densely white-canescent on both sides; inflorescence branched, open; racemes elongated, 2–8 cm. long; calyx canescent and hispid-ciliate; lobes narrowly linear, obtuse, two thirds as long as the corolla, with a rather strong midvein; corolla pubescent, white, 4–5 mm. long; stamens about twice as long as

the corolla, villous-bearded; seeds 4, dark chestnut-brown, 2 mm. long, puberulent, ellipsoid, strongly but finely faveolate.

This resembles *P. leucophylla* Torrey in general habit, but differs in the narrow and more strongly ribbed calyx-lobes, the smaller and white corolla, and the more finely faveolate seeds.

IDAHO: Snake Country, *Burke* (type, in herb. Columbia Univ.).

WASHINGTON: Collector not given.

Phacelia leptosepala sp. nov.

Perennial, with a taproot and a more or less cespitose root-stock; stems ascending, hirsute, 1–3 dm. high; leaves usually simple, hirsute on both sides, 5–10 cm. long, oblanceolate or elliptic; the lower ones petioled; inflorescence with several short branches; calyx hirsute; lobes narrowly linear, hirsute, nearly as long as the corolla, acute; corolla white, glabrous or nearly so, 5 mm. long; filaments about twice as long, sparingly villous-bearded.

This species is probably most nearly related to *Phacelia nemoralis* Greene, but differs in the low, slender, ascending stems, the cespitose habit, the longer and narrower, acute sepals, and the less bearded stamens. It somewhat resembles *P. alpina* in habit, but differs in the narrow calyx-lobes almost equaling the white corolla and in the hirsute pubescence, which consists only of coarse hairs.

BRITISH COLUMBIA: Vermilion Lake, Aug. 5, 1905, *Edith M. Farr 1013* (type, in herb. N. Y. Bot. Gard.); Avalanche débris above Lardo, Selkirk Mountains, June 16, 1905, *Shaw 695*.

MONTANA: Mount MacDougal, 1901, *Umbach 139*; Sperry Glacier, 1903, *Umbach 826*.

Lappula leucotricha sp. nov.

Annual; stem 2–4 dm. high, slender, branched above, densely pilose, especially below, with long white hairs; basal leaves oblanceolate, 2–4 cm. long, softly pilose on both sides; stem-leaves linear or oblong, numerous; bracts linear-lanceolate; sepals linear, 2.5–3 mm. long, in fruit 4–5 mm.; corolla white, 3–3.5 mm. long, 3 mm. broad; fruit erect, about 5 mm. wide; nutlets about 2.5 mm. long, light, almost straw-colored; marginal prickles in one row, not united into a disk, but broadened below and flat, scarcely grooved; back strongly muricate.

This species is related to *Lappula occidentalis* (S. Wats.) Greene, but differs in the soft white spreading pubescence, the white

flowers, the smaller fruit with broader, flattened prickles. In *L. occidentalis* the prickles are only slightly broadened below, not flattened, and strongly grooved on the inside.

ARIZONA: Tucson, Apr. 20, 1894, *Toumey* (type, in herb. N. Y. Bot. Gard.); vicinity of Flagstaff, June 16, 1898, *MacDougal 122*; Clifton, Apr., 1881, *Rusby 281*.

UTAH: St. George, 1877, *Palmer 359*.

Eremocarya muricata sp. nov.

Annual; stem slender, branched throughout with ascending branches, strigose; leaves linear, 2–5 mm. long, hispidulous, the hairs with pustulate bases; racemes short and dense, usually less than 1 cm. long; bracts oblong, 1–2 mm. long; sepals linear, obtuse, 1.5 mm. long, hispidulous on the margins and midvein; corolla white, 1 mm. long; limb scarcely 0.5 mm. wide; nutlets lanceolate in outline, long-acuminate, dull, finely muricate.

This species is somewhat intermediate between *Eremocarya micrantha* and *E. lepida*. It resembles the former most in habit, but differs in the more ascending branches, the shorter leaves, and especially in the narrower, muriculate and dull, instead of smooth and shining, nutlets. The latter resemble much those of *E. lepida*, but are narrower and more tapering upwards. *E. lepida* has much broader leaves and larger flowers.

UTAH: Southern Utah, 1874, *Parry 164* (type, in herb. Columbia Univ.).

ARIZONA: Near Camp Lowell, Apr. 13, 1881, *Pringle*; Prescott, 1883, *Rusby 745*; Tucson Mountains, Apr. 12, 1903, *Thornber*; Plains of Tucson, Apr., 1881, *Lemmon 203*; Mesa, near Tucson, May 14, 1883, *Pringle*; Apr. 25, 1906, *Shear 4235*; Tucson, Apr. 3, 1894, *Toumey*.

Greeneocharis circumscissa (H. & A.) Rydb. comb. nov.

Lithospermum(?) circumscissum H. & A. Bot. Beech. 370. 1840.

Piptocalyx circumscissus Torr.; S. Wats. Bot. King's Exp. 240. 1871.

Eritrichium circumscissum A. Gray, Proc. Am. Acad. **10**: 58. 1874.

Krynitzkia circumscissa A. Gray, Proc. Am. Acad. **20**: 275. 1885.

Wheelerella circumscisssa Grant, Bull. So. Calif. Acad. Sci. **5**: 28. 1906.

Piptocalyx Torr. of 1871 is antedated by *Piptocalyx* Oliver of 1870 and therefore *Greeneocharis* Gürke & Harms was proposed instead of the former in the appendix to the Register of the Engler & Prantl, Natürlichen Pflanzenfamilien.* This name was properly published, although no binomials were used. There was therefore no need of substituting another generic name *Wheelerella* as was done by Grant. The fact that the etymology is not as good as it might be does not at all invalidate *Greeneocharis*. Reluctantly the writer is forced to add another binomial to the already too many names of this plant.

Oreocarya spicata sp. nov.

Perennial, with a taproot; stem solitary and simple, virgate, hispid throughout; basal leaves numerous, spatulate, 2–5 cm. long, hispid on both sides; the hairs usually with pustulate bases; stem-leaves linear-oblanceolate or linear, 4–9 cm. long, those of the inflorescence many times longer than the short flower clusters; inflorescence elongated, spike-like; calyx hispid, 4–5 mm. long, lobes oblong-lanceolate, obtuse; corolla 6 mm. long, 4 mm. broad; nutlets 4 mm. long, ovate in outline, scarcely keeled on the back, white and shining, smooth on the back, margins merely acute.

This species is closely related to *Oreocarya virgata*, from which it differs in the light-colored, smooth nutlets, the smaller corolla-limbs, shorter and broader basal leaves. The nutlets in *O. virgata* are more acuminate, brown or brownish gray, with a more distinct ridge on the back, more or less transversely rugose and tubercled on the back, and with sharper margins.

COLORADO: Artist's Glen, Aug. 1, 1901, *Clements 102* (type, in herb. N. Y. Bot. Gard.); North Cheyenne Cañon, July 14, 1896, *Ernst A. Bessey*; "Colorado," *G. W. Hulse.*

Cryptanthe leptophylla sp. nov.

Annual; stem simple, slender, erect, strigose throughout, 1.5–3 dm. high; leaves narrowly linear, 1–3 cm. long, 0.5–1.5 mm. broad, strigose; inflorescence cymose, short, at the end of the stem, and on a few small branches; calyx-lobes linear-filiform,

*Gesamtregister 462. 1899.

3–4 mm. long, in fruit 8–10 mm. long, white-silky with long spreading hairs; corolla minute, shorter than the calyx; limb hardly 0.5 mm. wide; nutlets 3 mm. long, narrowly lanceolate, long-acuminate, strongly muricate; groove closed, 2-forked at the base.

The type sheet of this species was determined by Dr. Watson as *Eritrichium barbigerum*. It is abundantly distinct from *Cryptanthe barbigera*, however, the main distinctions being the narrow strigose leaves, the strigose instead of hirsute or hispid stem, the minute corollas, and the narrower and differently shaped nutlets.

UTAH: St. George, 1877, *E. Palmer 350* (type, in herb. Columbia Univ.).

Cryptanthe confusa sp. nov.

Cryptanthe affinis Rydb. Mem. N. Y. Bot. Gard. 1: 330, in part. 1900.

Annual; stem rather stout, hispid, branched; leaves oblong or oblong-oblanceolate, 2–5 cm. long, 3–8 mm. wide, coarsely hirsute; spikes at first very short, subcapitate, in age 4–5 cm. long; calyx-lobes 2 mm. long, lance-subulate, hispid, in fruit 3–4 mm. long; corolla about 3 mm. long; limb scarcely 1 mm. wide; nutlets ovate, 2 mm. long, light-colored, smooth, shining, thin-walled, attached by the lower half or two thirds; groove closed and simple to the base.

This species is related to *Cryptanthe affinis* and *C. leiocarpa*, but differs from both in the broader leaves. The nutlets are most like those of the former but the attachment extends somewhat higher.

WYOMING: Upper Madison Cañon, Yellowstone Park, Aug. 3, 1897, *Rydberg & Bessey 4884* (type, in herb. N. Y. Bot. Gard.).

IDAHO: Beaver Cañon, June 27, 1895, *Rydberg;* Latah County, July 6, 1894, *Piper 1940.*

UTAH: Central Utah, 1875, *Parry 67* (?).

Cryptanthe grandiflora sp. nov.

Annual; stem branched, 2–4 dm. high, hirsute with white hairs; leaves broadly linear, lanceolate, or oblong, 3–5 cm. long, 5–10 mm. wide, hirsute, the hairs with pustulate bases; spikes lax, in fruit often 1 dm. long; calyx-lobes 3 mm. long, in fruit 5 mm., very hispid; corolla white, 4–5 mm. long; limb 5–6 mm. wide; nutlets ovate, 2.5 mm. long, shining, smooth, rather thin-walled; groove narrow, 2-forked at the base.

This species has been variously named *Cryptanthe leiocarpa*, *C. ambigua*, and *C. Torreyana*. It differs from the first in the 2-forked groove, from the second in the smooth nutlets, and from all in the large corolla. It is most related to *C. Torreyana*, having somewhat similar nutlets, but is easily distinguished from it by the large flowers and broad leaves. It may be the same as the large-flowered form of *C. Torreyana calycosa* referred to by Piper;* but it does not have the elongated calyx-lobes of that species and has three to four times as broad corolla.

IDAHO: Valley of Clearwater River, April 23, 1892, *Sandberg, MacDougal & Heller 10* (type, in herb. N. Y. Bot. Gard.); about Lewiston, April 30, 1896, *A. A. & E. Gertrude Heller 2998*.

WASHINGTON: Wawawai, May, 1897, *Elmer 775*; near Montesano, June 10, 1898, *A. A. & E. Gertrude Heller 3924*.

Mertensia pallida sp. nov.

Perennial, with a thick rootstock; stem glabrous, very pale, 5–8 dm. high, leafy; lower leaves oblanceolate, the upper narrowly lanceolate, 5–8 cm. long, glabrous or minutely muriculate, ciliolate on the margins, pale; inflorescence narrowly paniculate; pedicels usually strigulose or sometimes the hairs represented only by the somewhat pustulate bases; calyx-lobes oblong, about 1 mm. long, obtuse, ciliate on the margin; corolla about 1 cm. long, the tube about equaling the limb; filaments about 1 mm. long, dilated and at the apex broader than the anthers, which are about 2 mm. long.

This is related to *Mertensia ciliata* but differs in the paler narrower leaves, the smaller corolla, and the usually strigulose pedicels.

MONTANA: Lima, June 28, 1895, *Rydberg 2777* (type, in herb. N. Y. Bot. Gard.); June 30, 1895, *Shear 3395*; Spanish Basin, July 11, 1896, *Flodman 751*.

Mertensia Leonardi sp. nov.

Perennial, with thick rootstock; stem erect, glabrous, pale, 5–10 dm. high, leafy; leaves thin, glabrous and smooth beneath, more or less pustulate-muricate above, and ciliolate on the margins; the lower short-petioled; blades oblanceolate, 4–7 cm. long; the upper sessile, lanceolate or ovate, 5–15 cm. long; inflorescence much branched; pedicels sparingly pustulate; calyx-lobes lanceo-

* Contr. U. S. Nat. Herb. 11: 484. 1906.

late, 4 mm. long, twice as long as the calyx-tube, ciliolate on the margins; corolla-tube 6–7 mm. long; limb 8–10 mm. long, 7–8 mm. wide.

This is related to *Mertensia arizonica*, *M. intermedia*, and *M. stenoloba*. From the former it differs in the long calyx-lobes and the short calyx-tube and from the latter two in the long and ample limb of the corolla. It is a larger plant than any of the three and often reaches a height of 1 m.

UTAH: Mill Creek Cañon, July 31, 1884, *F. E. Leonard* (type, in herb. N. Y. Bot. Gard.).

Mertensia humilis sp. nov.

Perennial, with a woody tap-root and cespitose caudex; stem 1–2 dm. high, ascending or decumbent, glabrous; basal leaves petioled, 3–8 cm. long; blades thick, elliptic to ovate, glabrous beneath, pustulate-muricate above, ciliolate on the margins, stem-leaves sessile, elliptic or ovate, rarely oblong, 2–4 cm. long; pedicels with scattered large pustules; calyx-lobes lanceolate, 2–3 mm. long, hispid-ciliolate on the margins; corolla 7–8 mm. long; tube slightly shorter than the limb; stamens inserted in the tube of the corolla; filaments short and narrow.

The specimens referred to this species were all named *Mertensia alpina* by the collectors. A few years ago the present writer regarded them as representing the typical *M. alpina* and redescribed the true *M. alpina* (Torr.) Don under the name *M. obtusiloba*. A reëxamination of James's plant (type of *M. alpina*) has convinced me of the identity of *M. alpina* and *M. obtusiloba*. *M. humilis* combines the corolla and stamens of *M. alpina* with the leaf-surface, pedicels, and calyx of *M. lanceolata*. In habit it is intermediate between the two.

WYOMING: Sand Creek, Albany Co., June 2, 1900, *A. Nelson 7043*; (type, in herb. N. Y. Bot. Gard.); Laramie Hills, May 16, 1894, *A. Nelson 33*; May 14, 1900, *E. Nelson 184*.

Scutellaria veronicifolia sp. nov.

Perennial, with creeping rootstock; stem 2–4 dm. high, finely puberulent, more or less purplish; leaves below the inflorescence ovate, obtuse, coarsely crenate, 1–4 cm. long, minutely puberulent or glabrate, short-petioled; those of the inflorescence and branches oblong and entire or nearly so; pedicels 3–5 mm. long; calyx

finely pubescent, 6 mm. long; corolla 25–30 cm. long, its tube rather abruptly widening, 7–8 mm. broad at the throat.

This species is related to *Scutellaria angustifolia* and *S. antirrhinoides*, but differs from both in the broader corolla-tube. From the former it differs also in the broader and usually toothed stem-leaves and from the latter in the large flowers.

IDAHO: *Sandberg, MacDougal, & Heller 115* (type, in herb. N. Y. Bot. Gard.).

CALIFORNIA: Mokelumne Hill, 1853–4, *Bigelow* (Whipple Exp.); 1846, *Fremont LIII.*

Stachys asperrima sp. nov.

Perennial, with a rootstock; stem stout, 4–6 dm. high, coarsely hispid on the angles with spreading or reflexed hairs; leaves nearly sessile, oblong, elliptic, or oblong-lanceolate, 5–8 cm. long, truncate or rounded at the base, coarsely crenate, hispid above, hispid on the veins and also puberulent beneath; spike 1–2 dm. long; calyx densely hispid and somewhat glandular; lobes lance-subulate, spinulose-tipped; corolla purplish, 10–12 mm. long, puberulent, and more or less hirsute on the lips outside.

This species belongs to the *Stachys palustris* group, but little resembles that species in general habit. In leaf-form, pubescence, and general habit, it reminds one of *S. arenicola* Britton, but the leaves are crenate instead of serrate and the pubescence is coarser. It resembles also *S. rivularis* Heller, but the pubescence is coarser and the calyx-lobes are lance-subulate instead of lanceolate.

UTAH: Towards Jordan City, July 7, 1884, *F. E. Leonard 138* (type, in herb. N. Y. Bot. Gard.).

Stachys Leibergii sp. nov.

Perennial, with a horizontal rootstock; stem 3–6 dm. high, sharply angled, glabrous below, softly hirsute above; leaves sessile, lanceolate, acute, 4–8 cm. long, crenate-dentate, pubescent on both sides with short appressed hairs or in age glabrate; bracts lanceolate, mostly entire, often purplish-tinged; calyx softly pubescent, often purplish; tube obpyramidal, about 4 mm. long; lobes lanceolate, gradually setose-acuminate, almost as long as the tube; corolla about 12 mm. long, rose-colored, glabrous.

This species is related to *Stachys palustris* and *S. scopulorum.*

From the former it differs in the more gradually acuminate and almost erect calyx-teeth, and from the latter in the short appressed pubescence of the leaves, and the usually glabrous lower part of the stem.

IDAHO: Low meadow, Blue Creek, alt. 700 m., Coeur d'Alene Mountains, July 20, 1895, *John B. Leiberg 1328* (type, in U. S. Nat. Herb. *no. 250,811*); Valley of Coeur d'Alene River, Kootenai Co., July 13, 1892, *Sandberg, MacDougal, & Heller 639*, in part.

Stachys ampla sp. nov.

Perennial, with a rootstock; stem 5–7 dm. high, softly hirsute and more or less viscid, especially above; leaves ovate to lanceolate, 5–10 cm. long, sessile or nearly so, rounded or subcordate at the base, acute at the apex crenate-serrate, softly pubescent on both sides and more or less glandular-granuliferous; spike interrupted, very leafy; calyx soft-pubescent and glandular, about 9 mm. long; lobes lance-subulate, spinulose-tipped; corolla rose-colored or pink, about 15 mm. long, somewhat puberulent without; lower lip very broad; lateral lobes half as broad and three fourths as long as the middle one.

This species is related to *S. scopulorum* and *S. teucriformis* but differs from both in the larger corolla, the broader lower lip, and the unusually large lateral lobes of the lip.

SOUTH DAKOTA: Custer, Black Hills, Aug. 20, 1892, *Rydberg 1208* (type, in herb. N. Y. Bot. Gard.).

Audibertiella argentea sp. nov.

A low shrub; branches cinereous-puberulent; leaves petioled, 1–2 cm. long; blades rounded, obovate-spatulate, rounded or retuse at the apex, scurfy-cinereous, at first silvery white; bracts broadly obovate, about 1 cm. long, membranous, strongly veined, puberulent and ciliate; corolla blue, about 1 cm. long; lower lip only slightly longer than the upper one, its lobes short and rounded; longer filaments about 12 mm. long, anther-bearing connective 2.5–3 mm. long, sterile connective lacking.

Dr. E. L. Greene* separated *Audibertia polystachya* Benth. from the rest of the genus, as understood by Bentham and Gray, and proposed the name *Ramona* for this species. The other species he reduced to *Salvia*. Briquet, ignorant of Greene's work, discov-

* Pittonia 2: 235.

ered (as Greene had done) that *Audibertia* could not hold for this genus, as the name had been applied two years earlier to a section of *Mentha*, proposed the name *Audibertiella*,* and renamed all the known species under this genus. Later he discovered that Greene had proposed the name *Ramona* for one of the species. He, however, did not agree with Greene that the genus, with that species excepted, should be merged in *Salvia*. He therefore restored the genus as understood by Bentham and Gray, adopted Greene's name, and renamed the species under *Ramona*. The writer agrees with Greene in keeping *Ramona* as a distinct genus for *Audibertia polystachya*, but agrees with Briquet that none of the species should be merged into *Salvia*. It is therefore necessary to restore *Audibertiella* Briq. As this name was a substitute for the invalid *Audibertia*, the type species of the latter becomes the type of the former. The type is therefore *Audibertia incana* Benth. The type of *Ramona* was *Audibertia polystachya*. *Audibertia grandiflora* may represent a third genus.

The present species is a close relative to *A. incana* and has been confused with it. It differs in the broad rounded obovate-spatulate leaves, the smaller flowers and the comparatively shorter lower lip of the corolla. In *A. incana* the leaves are oblong-spatulate, often 3–4 cm. long, the corolla almost 1.5 cm. long, and its lower lip about half longer than the upper one. *A. incana* ranges from Washington to Idaho and Oregon. The range of *A. argentea* is much more southerly.

ARIZONA: Mokia Pass, 1877, *Palmer 395* (type, in herb. Columbia Univ.); 1876, *Palmer 358*.

UTAH: St. George, 1874, *Parry 159*; 1872, *Bishop*.

NEVADA: Monitor Valley, 1868, *S. Watson 829*; Kernan, Meadow Valley Wash, April 29, 1902, *Goodding 655*; Palisade, June 14, 1882, *M. E. Jones 4035*; Miller Mountain, 1883, *Shockley*; Charleston Mountain, 1898, *Purpus 6072*.

CALIFORNIA: Surprise Cañon, Panamint Mountains, *Coville & Funston 601*; Panamint Cañon, May 4, 1897, *M. E. Jones*; Providence Mountains, May, 1902, *Brandegee*; Mojave Desert, May 30, 1901, *Parish 4935*.

* Bull. Herb. Boiss. 2 : 73.

Hedeoma longiflora sp. nov.

Perennial, with a slender taproot; stems branched at the base, decumbent or ascending, finely puberulent; leaves spreading, linear-lanceolate, lanceolate or oblong, 1–2 cm. long, grayish-puberulent, subsessile; calyx 7–8 mm. long, strongly ribbed, puberulent, somewhat saccate below; teeth subulate, the lower 2 mm., the upper 1 mm. long; corolla about 12 mm. long, puberulent, with an ample limb.

This has been confused with *Hedeoma Drummondii*, but differs in the broader leaves, which are divergent, and in the calyx, which is distinctly saccate. *H. Drummondii* differs from the related species in the narrow, ascending or suberect leaves and the narrow calyx, scarcely at all saccate. *H. longiflora* has the long corolla of *H. Drummondii* and is distinguished thereby from *H. sancta*, *H. thymoides*, and *H. ovata*, which have all been included in *H. Drummondii*. It grows on cliffs and in cañons of the Great Plains region.

NEBRASKA: Cliffs of cañons of Banner Co., 1890, *Rydberg X297* (type, in herb. N. Y. Bot. Gard.); Court House Rock, 1891, *Rydberg 297*.

SOUTH DAKOTA: Custer, June 16, 1892, *Rydberg 941*; Rapid Creek, 1891, *T. A. Williams*.

KANSAS: Wet rocks, Stanton Co., Aug. 5, 1895, *Hitchcock 402*.

Madronella sessilifolia sp. nov.

Perennial, with a short caudex; stems stout, about 3 dm. high, finely puberulent, densely so above; leaves sessile or nearly so, ovate or lanceolate, entire, obtuse, rather pale, finely puberulent or in age glabrous; bracts oval, 10–12 mm. long, puberulent on the back, ciliate on the margins; calyx 8–9 mm. long, pilose, striate; lobes lanceolate, about 1 mm. long; corolla 12–13 mm. long, pubescent.

The type was determined as *Monardella odoratissima*, but it differs from that species in the pale foliage, the shorter and finer pubescence, the broader leaves, and the less distinctly ciliate calyx-lobes.

UTAH: St. George, 1877, *Palmer 393* (type, in herb. N. Y. Bot. Gard.).

Madronella oblongifolia sp. nov.

Perennial, suffruticose at the base; stems 1–3 dm. high, grayish puberulent or in age glabrate; leaf-blades oblong, 1–3 cm. long, minutely puberulent, or in age glabrate, entire, obtuse, usually with distinct, but short, slender petioles; bracts pale or tinged with rose, finely puberulent, ciliate on the margins, oval, 9–12 mm. long; calyx about 1 cm. long, pilose; its teeth lanceolate, and strongly ciliate; corolla white to rose-colored, 12–14 mm. long, puberulent.

This has been confused with *M. odoratissima*, but differs in the shorter pubescence, which is sometimes wholly lacking on the older leaves, the merely puberulent instead of pilose bracts, the more distinctly petioled leaves, and more suffruticose habit. It grows on mountain sides at an altitude of 1500–3000 m.

UTAH: Mount Nebo, 1905, *Rydberg & Carlton 7706* (type, in herb. N. Y. Bot. Gard.), *7757* and *7700*; mountains north of Bullion Creek, near Marysvale, *7178*; American Fork, 1885, *Leonard 178*; Logan, Aug. 9, 1895, *Shear 3164*; same locality and date, *Rydberg*; Alta, July 30, 1879, *M. E. Jones 1109*; Central Utah, 1873, *Parry 75*.

Mentha glabrior (Hook.) Rydb. sp. nov.

Mentha canadensis glabrata Benth. Lab. 181. 1833. Not *M. glabrata* Vahl. 1794.

Mentha canadensis glabrior Hook. Fl. Bor.-Am. **2**: 111. 1838.

Mentha canadensis borealis Piper, Contr. U. S. Nat. Herb. **11**: 492, in part. 1906. Not *M. borealis* Michx. 1803.

This differs from *Mentha canadensis* in the almost glabrous leaves and stem, and much shorter pubescence on the calyx. Recently several botanists have included *M. Penardi* (*M. arvensis Penardi* Briq.) in *M. canadensis glabrata* or *M. arvensis glabrata*, but I think they are distinct. In *M. Penardi* the leaves have much shorter petioles, nearly always shorter than the flower-clusters, the stem is more hairy and the calyx-teeth are lanceolate and acute, much longer than broad. *M. glabrior* has the abruptly acuminate calyx-lobes of *M. canadensis* but they are not so short. This species has been taken as *M. borealis* Michx., and even Bentham cited the latter as a synonym, but by reading Michaux's

description, one can easily see that it without any doubt refers to the true *M. canadensis*. *M. canadensis* is not found in the Rocky Mountain region, and *M. glabrior* is very rare. The common plant of the Rockies is *M. Penardi* and that of the Pacific slope is *M. lanata*, discussed below.

Mentha lanata (Piper) Rydb. sp. nov.

Mentha arvensis lanata Piper, Bull. Torrey Club **29**: 223. 1902.

Mentha canadensis lanata Piper, Contr. U. S. Nat. Herb. **11**: 492. 1906.

I think that this deserves specific rank, differing not only in the amount but also in the kind of pubescence and in the shape of the calyx lobes. Sometimes the leaves are very densely villous, almost white. Its range extends from British Columbia to Idaho and California. The specimens from Maine accredited to this by Robinson and Fernald * probably represent unusually hairy specimens of *M. canadensis* and not this.

Mentha occidentalis sp. nov.

Perennial, with a rootstock; stem 3–6 dm. high, with short crisp pubescence, at least on the angles above; petioles 5–10 mm. long; leaf-blades ovate or ovate-lanceolate, short-acuminate, strongly serrate, 4–8 cm. long, minutely pubescent on both sides or in age glabrate; bracts linear-lanceolate, 1 cm. long or more, usually exceeding the flowers; calyx about 3 mm. long, pilose, teeth lanceolate, acute or acuminate, longer than broad; corolla white or pink, 5–6 mm. long; its lobes oblong, obtuse.

This has been confused with *Mentha canadensis* and *M. glabrata*, but differs from all the species of this group in the long linear-lanceolate bracts, longer than the flower clusters, and the larger corollas. Otherwise it comes nearest *M. Penardi*.

IDAHO: Forest, Nez Perces County, 1896, *A. A. & E. Gertrude Heller 3486* (type, in herb. Columbia Univ.).

WASHINGTON: 1889, *Vasey 463*; Chehalis River, 1897, *Lamb 1235*.

MONTANA: Jocko River, Aug. 27, 1897, *Elrod and assistants 213*.

* Gray's New Manual 711. 1908.

Scrophularia serrata sp. nov.

Perennial; stem 1–2 m. high, angled, sparingly puberulent or glabrous, slightly glandular in the inflorescence; leaf-blades ovate or cordate, 5–15 cm. long, regularly serrate with the teeth directed forward, acute or short-acuminate, minutely glandular-puberulent on both sides; bracts rather conspicuous, linear-lanceolate, the lowest 2–3 cm. long; calyx-tube hemispheric, glabrous or nearly so, 2 mm. long; lobes rounded, 2 mm. long; corolla-tube short, 6–7 mm. long, nearly 5 mm. thick; upper lip 4–5 mm. long; sterile stamen obovate-spatulate, purple.

This species is related to *Scrophularia marilandica* and *S. neglecta*. From both it differs in the stout, strongly ascending, instead of more or less spreading branches of the inflorescence; from the former in the larger corolla (about twice as large) and from the latter in the shorter corolla-tube, scarcely twice as long as the calyx, and the finely glandular-puberulent, instead of densely pubescent lower leaf-surfaces. In *S. neglecta* the corolla-tube is about three times as long as the calyx. *S. occidentalis*, the common Rocky Mountain species, has doubly toothed or incised leaves with spreading teeth and a reniform greenish sterile stamen.

IDAHO: Wet places, Granite, N. Idaho, July, 1887, *J. H. Sandberg* (type, in herb. N. Y. Bot. Gard.).

Pentstemon subglaber Rydb. nom. nov.

Pentstemon glaber utahensis S. Wats. Bot. King's Exp. 217. 1871.

Pentstemon utahensis A. Nels. Bull. Torrey Club **26**: 242. 1899. Not *P. utahensis* Eastw. 1893.

PENTSTEMON ALPINUS [A] Torr. Ann. Lyc. N. Y. **1**: 35. 1823

Pentstemon oreophilus Rydb. Bull. Torrey Club **31**: 642. 1905.

A reëxamination of the type of *Pentstemon alpinus* has persuaded me that it is the same as my *P. oreophilus* and not as I thought, the same as *P. riparius* A. Nelson. The latter should therefore be restored.

Pentstemon auricomus A. Nels. sp. nov.

Pentstemon Jamesii A. Nelson, Bull. Torrey Club **25**: 547. 1898. Not *P. Jamesii* Benth. 1846.

I had some correspondence with Professor A. Nelson in 1898, when the latter segregated *Pentstemon similis* from *P. Jamesii*. I think that I then led Professor Nelson astray. At least, I had made a rather serious mistake. Professor Nelson made the following statement in his article in the BULLETIN cited above:

"Before I began work upon these collections Dr. Rydberg had satisfied himself that his Dakota plant closely duplicated the type of *P. Jamesii* which is preserved in the Torrey Herbarium at Columbia University, and with which he has done me the favor of comparing my specimens."

A more thorough investigation of the South Dakota plant shows that the sterile stamens are but slightly bearded and of a different shape and the specimens must be referred to a form of *P. albidus*. The type of *P. Jamesii* consists of two scraps, only the tops of the plant. The bracts, the calyx, and corolla of these scraps resemble closely those of Nelson's plants from Wyoming. The basal leaves of *P. Jamesii* are, however, entirely different from those of Nelson's plant. At the time, there were no good specimens of *P. Jamesii* in the herbaria here in New York, but I have myself collected good specimens near the type locality, which was somewhere on the upper Arkansas River. These show that *P. Jamesii* is much closer to *P. similis* A. Nels., differing in the smaller corolla, the less secund inflorescence, the longer bracts and narrower basal leaves. Typical *P. Jamesii* is represented by *Rydberg & Vreeland 5637, 5636, 6610, 5635* and *5633;* also by *Baker 6* of 1901 and *Osterhout 2084* of 1900.

As the plant described by Professor Nelson at the place cited above is very distinct I adopt the name under which Professor Nelson had distributed the plant, viz., *Pentstemon auricomus*, especially as I, at least indirectly, was the cause of its being suppressed.

PENTSTEMON SUFFRUTESCENS Rydb. Bull. Torrey Club **28**: 503. 30 S 1901

P. caespitosus suffruticosus A. Gray, Syn. Fl. **2**[1]: 270. 1878.

P. procumbens Greene, Pl. Baker. **3**: 23. 18 N 1901.

Professor A. Nelson, in describing *Pentstemon Xylus*,* expressed his opinion that the latter was the same as *P. caespitosus suffruti-*

* Bot. Gaz. **34**: 31. 1902.

cosus A. Gray. A careful reading of the original short description of Gray's variety will reveal to anyone that it cannot apply to *P. Xylus*. As *P. suffrutescens* was based exclusively on Gray's variety, it can by no means be called a *nomen nudum* as Professor Nelson is inclined to regard it. To it I refer also *P. procumbens* Greene published nearly two months later.

Pentstemon Thompsoniae (A. Gray) Rydb. sp. nov.

Pentstemon pumilus Thompsoniae A. Gray, Syn. Fl. **2**[1]: 269. 1878.

This is a very distinct species, not related to *P. pumilus*. Dr. Gray at first * placed *Pentstemon pumilus* with *P. albidus*, *P. Jamesii*, and *P. cristatus*, *i. e.*, in a group to which it rightly belongs, notwithstanding its small size. Afterwards,† he transferred it wrongly to the *P. caespitosus* group, with which it has little in common. *P. Thompsoniae* on the contrary belongs to this group and is a close relative to *P. caespitosus*. I suspect that Dr. Gray has redescribed the true *P. pumilus* Nutt. under the name *P. miser*.‡ I have not seen the type of the latter but the description agrees well with *P. pumilus*.

Pentstemon platyphyllus sp. nov.

Pentstemon heterophyllus latifolius S. Wats. Bot. King's Exp. 222. 1871. Not *P. latifolius* Hoffmgg. 1824.

Dr. Gray in the Synoptical Flora § refers this doubtfully to *Pentstemon azureus Jaffrayanus* Gray (*P. Jaffrayanus* Hook.). The two resemble each other in leaf form and general habit, but there are differences important enough to make them distinct species. I am also inclined to think that *P. Jaffrayanus* is specifically distinct from *P. azureus*, although I have not seen any authentic specimen of the latter. The leaves in *P. Jaffrayanus* are strongly glaucous and the upper are subcordate and clasping at the base; the calyx-lobes are oval or obovate, abruptly short-acuminate or mucronate with an erect tip; the anthers are somewhat hirsutulous at the sinus as well as papillose-hispidulous on the margins; and the sterile

* Proc. Am. Acad. **6**: 67. 1862.
† Syn. Fl. **2**[1]: 269. 1878.
‡ Syn. Fl. ed. 2, **2**[1]: 441. 1886.
§ **2**[1]: 272. 1878.

stamen is filiform. In *P. platyphyllus* the leaves are less glaucous, never subcordate or clasping at the base; the calyx-lobes are ovate, long-acuminate, with more or less spreading tips; the anthers are merely papillose-hispidulous on the margins but otherwise without pubescence; and the sterile stamen is decidedly broadened upwards. *P. platyphyllus*, as far as the writer knows, is found in Utah only, while *P. Jaffrayanus* grows in California and Oregon. To the former belong the following specimens:

UTAH: Cottonwood Cañon, July, 1869, *S. Watson 787;* City Creek Cañon, July 25, 1879, *M. E. Jones 1080;* also July 7, 1880; same locality, July 4, 1883, *Leonard 141*, and Aug. 9, 1884, *208;* mountains near Ogden, July, 1871, *Coulter.*

Pentstemon coccinatus sp. nov.

(?) *Pentstemon Eatonii undosus* Jones, Proc. Calif. Acad. **5**: 715. 1895.

Perennial, with a woody caudex; stem erect, 3–6 dm. high, puberulent; basal leaves petioled; blades ovate or elliptic, acute at both ends, 3–7 cm. long, densely puberulent; lower stem-leaves spatulate to elliptic; the upper ovate or ovate-lanceolate, acuminate; inflorescence lax, more or less secund; calyx about 5 mm. long, puberulent; lobes broadly ovate, abruptly short-acuminate, scarious-margined and denticulate; corolla red, about 2.5 cm. long, nearly tubular, not ventricose, slightly bilabiate, lobes short, rounded; anthers papillose on the margin, glabrous; sterile stamen glabrous, club-shaped, truncate; capsule about 1 cm. long.

This has been confused with *P. Eatonii*, but differs in the puberulent stem and leaves, the more acuminate upper leaves and sepals.

ARIZONA: Grand Cañon of the Colorado, 1898, *MacDougal 173* (type, in herb. N. Y. Bot. Gard.); Oak Creek, June 23, 1883, *Rusby;* Red Cañon Trail, June 10, 1901, *L. F. Ward.*

UTAH: Court House Wash, May, 1892, *Eastwood;* South Utah, 1877, *Palmer 372;* 1874, *Parry 149.*

Synthyris dissecta sp. nov.

Synthyris pinnatifida Rydb. Mem. N. Y. Bot. Gard. **1**: 353. 1900. Not S. Wats. 1871.

Acaulescent perennial, with a short, thick, erect rootstock; leaves 5–10 cm. long, petioled, villous-tomentose; blades oval in

outline, twice or thrice pinnatifid into oblong or lanceolate divisions; scape villous-tomentose, 5–20 cm. high; spike dense or in fruit more lax; bracts and calyx densely white-villous; corolla about 6 mm. long, dark-blue or purple, or in age paler; lobes broadly obovate; stamens slightly exserted; ovary villous; fruit obovate, 6 mm. long, villous or in age glabrate.

This species is related to *Synthyris pinnatifida*, and has been mistaken for it, but it differs in the more copious pubescence, especially on the calyx and ovary (in *S. pinnatifida* these are glabrous or merely puberulent on the margins), in the larger dark corolla with obovate instead of oblong lobes, and in the larger fruit. *S. dissecta* grows at an altitude of 2000–3000 m.

MONTANA: Near Bozeman, June 11, 1900, *Chesnut & Jones 199* (type, in herb. N. Y. Bot. Gard.); Bridger Mountains, June 15, 1897, *Rydberg & Bessey 4927*; same locality, 1899, *Flaherty*, and June 26, 1899, *Blankinship*; Old Hollowtop, July 7, 1897, *Rydberg & Bessey 4926*; Beaver Head Co., June, 1888, *Tweedy 70*.

WYOMING: Headwaters, Cliff Creek, Aug. 9–18, 1900, *C. C. Curtis* (good fruit).

Thalesia Sedi (Suksd.) Rydb. comb. nov.

Aphyllon Sedi Suksd. Deuts. Bot. Monats. **18**: 155. 1900.

The three species of the Columbia River region, which have usually been included in *Thalesia uniflora*, differ from the plant of the eastern United States in their longer attenuate calyx-lobes. In all three the lobes are about twice as long as the calyx-tube and narrowly subulate from a broad base; in *T. uniflora* they are scarcely longer than the tube, lanceolate and gradually tapering from the base of the apex. *T. Sedi* differs from the other two Columbian species in the lighter-colored corolla, with narrower, oblong acutish or obtuse lobes, while *T. purpurea* Heller and *T. minuta* (see below) have dark purple corolla and broad, oval or semiorbicular lobes rounded at the apex or sometimes even retuse. It grows on species of *Sedum* and is distributed through parts of Oregon, Washington, and western Montana.

Thalesia minuta (Suksd.) Rydb. comb. nov.

Aphyllon minutum Suksd. Deuts. Bot. Monats. **18**: 155. 1900.

This resembles *Thalesia purpurea* in the color of the flower

and the form of the calyx, but the corolla is much smaller, only 15–20 mm. long, more strongly curved, and less funnelform. The corolla of *T. purpurea* is 2–3 cm. long, and more open at the throat. *T. minuta* has been reported parasitic on *Lithophragma*, but may grow on other hosts. It has been collected in Oregon, Washington, Montana, and British Columbia.

Thalesia lutea (Parry) Rydb. comb. nov.

Phelipaea lutea Parry, Am. Nat. **8**: 214. 1874.

Aphyllon fasciculatum luteum A. Gray, Syn. Fl. **2**[1]: 312. 1878.

This differs from *Thalesia fasciculata* not only in the sulphur-yellow corolla, but also in the acutish corolla-lobes and in the acute rather than acuminate calyx-lobes. It is parasitic on grasses instead of on composites, etc.

MYZORRHIZA Philippi, Linnaea **29**: 36. 1857

Aphyllon § *Nothaphyllon* A. Gray, Bot. Calif. **1**: 584. 1876.

Orobanche § *Myzorrhiza* G. Beck, Bibl. Bot. **4**: 78. 1890.

Following Beck von Mannagetta, many botanists in this country have reduced Gray's section *Nothaphyllon* of *Aphyllon* to *Orobanche*, while they have kept *Thalesia* distinct. Both, as well as a part of *Boschniakia*, were included in *Orobanche* by Beck. The editors of Gray's New Manual evidently took the genus *Orobanche* in the same sense as Beck. In contrasting *Conopholis* and *Orobanche* in the generic key, they give as characters for the former: "Calyx deeply cleft in front"; and for the latter: "Calyx 5-cleft." On the following page, however, they give as characters of *Orobanche minor*: "Calyx cleft before and behind almost or quite to the base," and for *O. ramosa*: "Calyx 4-lobed." *O. minor* is the only typical *Orobanche* found in this country, and this does not agree with the characterization of the genus, as given in the New Manual. Evidently the editors had Gray's genus *Aphyllon* in mind when the key was made.*

* Another inaccuracy in the treatment of *Orobanche* in the New Manual may be pointed out: *Orobanche purpurea* and *O. ramosa* are there characterized as having "each flower with 3 bracts (1 large and 2 small) at the base of the calyx," *O. minor* and *O. ludoviciana* as having "each flower with 1 or 2 bracts at the base of the calyx," and *O. uniflora* and *O. fasciculata* as being "without bracts." The characters

The typical *Orobanche* has the calyx characteristic of, for instance, *Castilleja* in Scrophulariaceae, *i. e.*, the calyx is deeply cleft in front and behind, with the lateral divisions entire or 2-cleft. None of our native American plants has this structure. They have all (except those included in *Boschniakia* by Gray) an almost equally 5-toothed calyx. There is a group of Old World plants, of which *Orobanche purpurea* and *O. ramosa* are introduced into this country, which have a 4-toothed or only occasionally 5-toothed calyx, but in that case the upper tooth is much smaller. In Gray's New Manual the former is described as having a "5-lobed" calyx. This is only occasionally the case. These species constitute the genus *Kopsia* Dum. or *Phelipaea* Nees (not Desf.). The writer thinks that the five sections of Beck's monograph should be regarded as genera. *Myzorrhiza* Philippi is the only available name for *Aphyllon* § *Nothaphyllon* Gray. This genus differs from *Thalesia* in habit and in the arrangement of the placentae, from *Orobanche* in the regularly 5-toothed instead of 2-cleft calyx, and from both in the presence of bractlets. The type of the genus is

MYZORRHIZA CHILENSIS Philippi, Linnaea **29**: 36. 1857
Orobanche chilensis G. Beck, Bibl. Bot. **4**: 82. 1890.

This is closely related to our most common North American species:

MYZORRHIZA LUDOVICIANA (Nutt.) Rydb.; Small, Fl. SE. U. S. 1093. 1903
Orobanche ludoviciana Nutt. Gen. **2**: 58. 1818.
Phelipaea ludoviciana Walp. Rep. **3**: 461. 1844.
Aphyllon ludovicianum A. Gray, Bot. Calif. **1**: 585. 1876.
? *Aphyllon arenosum* Suksd. Allg. Bot. Zeits. **12**: 27. 1906.

given for the two first are correct; there are three scales under the flower, one bract and two lateral bractlets; *Orobanche minor* has one bract and no bractlets, while *O. ludoviciana* has 1 or 2 bractlets under the flower. It has exactly the same arrangement as *O. purpurea* and *O. ramosa*, except that one of the bractlets is sometimes lacking and the bract is usually some distance below the calyx. *Orobanche uniflora* and *O. fasciculata* are not without bracts. They are without bractlets, but the bract is found at the base of the longer pedicel. They are like *O. minor* (a typical *Orobanche*) in having no bractlets, but differ in the 5-toothed instead of 2-cleft calyx. *O. ludoviciana* has bractlets and should have been associated with the two first species, if the presence or absence of bractlets was taken as the dividing character. In all the species the bracts are present although situated at different distances from the calyx, depending upon the length of the pedicels.

MYZORRHIZA MULTIFLORA (Nutt.) Rydb. Bull. Torrey Club **33**: 151. 1906

Orobanche multiflora Nutt. Jour. Acad. Nat. Sci. Phila. II. **1**: 179. 1848.

Phelipaea erianthera Engelm.; A. Gray, Proc. Am. Acad. **7**: 372. 1867.

Aphyllon multiflorum A. Gray, Bot. Calif. **1**: 585. 1876.

Myzorrhiza Cooperi (A. Gray) Rydb. comb. nov.

Aphyllon Cooperi A. Gray, Proc. Am. Acad. **20**: 307. 1885.

Orobanche ludoviciana Cooperi G. Beck, Bibl. Bot. **4**: 81. 1890.

Myzorrhiza tuberosa (A. Gray) Rydb. comb. nov.

Phelipaea tuberosa A. Gray, Proc. Am. Acad. **7**: 371. 1867.

Aphyllon tuberosum A. Gray, Bot. Calif. **1**: 585. 1876.

Orobanche bulbosa G. Beck, Bibl. Bot. **4**: 83. 1890.

Myzorrhiza pinorum (Geyer) Rydb. comb. nov.

Orobanche pinorum Geyer; Hook. Kew Jour. Bot. **3**: 297. 1851.

Phelipaea pinetorum A. Gray, Proc. Am. Acad. **7**: 371. 1867.

Aphyllon pinetorum A. Gray, Bot. Calif. **1**: 585. 1876.

Myzorrhiza Grayana (G. Beck) Rydb. comb. nov.

Orobanche comosa Hook. Fl. Bor.-Am. **2**: 92. 1838. Not *O. comosa* Wallroth. 1822.

Anoplanthus comosus Walp. Rep. **3**: 480. 1844.

Phelipaea comosa A. Gray, Pac. R. Rep. **4**: 118. 1857.

Aphyllon comosum A. Gray, Bot. Calif. **1**: 584. 1876.

Phelipaea carnosa [error] T. & G.; Coop. & Suckl. Nat. Hist. Wash. 50. 1859.

Orobanche Grayana G. Beck, Bibl. Bot. **4**: 79. 1890.

Myzorrhiza californica (Cham. & Schlecht.) Rydb. comb. nov.

Orobanche californica Cham. & Schlecht. Linnaea **3**: 134. 1828.

Phelipaea californica G. Don, Gen. Syst. **4**: 632. 1838.

Aphyllon californicum A. Gray, Bot. Calif. **1**: 584. 1876.

Myzorrhiza violacea (Eastw.) Rydb. comb. nov.

Aphyllon violaceum Eastw. Zoe **5**: 85. 1900.

Myzorrhiza xanthochroa (Nels. & Cockerell) Rydb. comb. nov.

Orobanche xanthochroa Nels. & Cockerell, Bot. Gaz. **37**: 278. 1904.

Myzorrhiza corymbosa sp. nov.

Stem 5–10 cm. high, corymbosely branched, glandular-puberulent; scales about 1 cm. long, lance-ovate, acute; bracts linear, about 1 cm. long; pedicels 5–10 mm. long; bractlets linear-subulate, half as long as the calyx; calyx-tube obconic, glandular-puberulent, 4 mm. long; lobes lance-subulate, about 1 cm. long; corolla dark purple, about 2.5 cm. long, tube 4–5 mm. wide; upper lip 7–8 mm. long, cleft about one third its length into ovate, obtuse or sometimes retuse lobes; lower lip cleft to the base into three lanceolate acutish divisions; anthers woolly.

This species has been confused with *M. californica* and *M. ludoviciana*, but is evidently most nearly related to *M. Grayana* (*Orobanche comosa* Hook.). In Hooker's Flora, the latter is described and figured as having emarginate corolla lobes. I doubt if that is a constant character. There is a fragment of Hooker's type in the Torrey herbarium; some of the lobes are evidently so, but in others this character is rather obscure. Good specimens, collected by Dr. Cooper on the Stevens' Expedition and also preserved in the Torrey herbarium, and a colored drawing, made for the report of the Wilkes' Expedition but never published, illustrate a plant with the lobes of the lower lip lanceolate, acute and entire at the apex. These and the specimen received from Hooker agree otherwise wholly in habit, size, structure, and color of the corolla. Whether the notching of the lower lobes is a specific character or not, may be decided by further field study. It is evident that the specimens cited here below are distinct enough from both. Hooker's and Cooper's plants have a corolla fully 3 cm. long, light purple and of a thinner texture, the lips are 12–15 mm. long, *i. e.*, about twice as long as in the plant here described, the upper lip is cleft to about the middle and the lobes of the lower lip are relatively narrower. The corolla of *M. corymbosa* resembles more in form, size, texture, and color that of *M. ludoviciana*, although the upper lip is less deeply 2-cleft. Occasionally one finds stunted specimens of *M. ludoviciana*, which in habit resemble this, but they can easily be recognized by the shorter calyx-

lobes and the glabrous anthers. The type of *M. corymbosa* was labeled *Aphyllon californicum*, but *M. californica* is a much larger plant in every respect, and its anthers are glabrous or nearly so.

IDAHO: Reynold's Creek, July 2, 1892, *Isabel Mulford* (type, in herb. Columbia Univ.).

WYOMING: Jackson's Hole, July 30, 1901, *Merrill & Wilcox 1177*.

MONTANA: Mountains near Indian Creek, July 22, 1897, *Rydberg & Bessey 4988*.

Valeriana pubicarpa sp. nov.

Perennial, with a rootstock; stem 2–4 dm. high, finely puberulent, not bearded at the nodes; basal leaves spatulate or oblanceolate, 2–6 cm. long, thin, glabrous or nearly so; stem-leaves 2-4 pairs, the lowest pair similar to the basal ones, the rest 3–5-foliolate or the uppermost minute and simple; leaflets oblong or lanceolate, rarely elliptic, 2–5 cm. long, entire; inflorescence short and dense, corymbiform or subcapitate; flowers mostly perfect; corolla funnelform, 4–6 mm. long, more or less pubescent; limb about 4 mm. wide; fruit finely pilose, 5 mm. long, 2 mm. wide.

This species has the habit of *Valeriana occidentalis* and *V. micrantha*, but the corolla of *V. Scouleri*. From the first, it differs in the longer corolla and the pubescent fruit; from the second, in a corolla twice as long and a denser inflorescence; from the last, in the narrower entire leaflets, and the pubescent fruit; and from all in the puberulent stem, which lacks the beard at the nodes and on the sheaths. It grows in the mountains at an altitude of 2,000–3,000 m.

UTAH: Mount Nebo, Aug. 15, 1905, *Rydberg & Carlton 7717* (type, in herb. N. Y. Bot. Gard.); also Big Cottonwood Cañon, June 28, *6374* and *6517*; Provo, June 16, 1902, *Goodding 1148*.

IDAHO: Ketchum, July 23, 1892, *Miss Mulford*.

MONTANA: Lima, June 29, 1895, *Rydberg 2794*; also *C. L. Shear 3389*.

Valeriana puberulenta sp. nov.

Perennial, with a thick rootstock; stem finely puberulent, not bearded at the nodes, 1.5–3 dm. high; basal leaves spatulate, 2–5 cm. long; stem-leaves 1–3 pairs, usually 3-foliolate; terminal

leaflet elliptic or oblong, or in the uppermost reduced pair lanceolate, 1–3 cm. long, the lateral ones oblong or lanceolate, about half as long; plant usually polygamo-dioecious; inflorescence of the essentially pistillate plant dense-corymbiform, that of the somewhat smaller essentially staminate plant subcapitate; corolla funnelform, 4–5 mm. long; limb 2.5–3 mm. wide; fruit glabrous, nearly 5 mm. long and 2 mm. wide.

This species has the pubescence of the preceding, but differs in the smaller stature, the smaller flowers, fewer and smaller leaves, glabrous fruit and a stronger tendency to be polygamo-dioecious. It grows in the mountains of Utah, at an altitude of 2,000–3,000 m.

UTAH: Mountains north of Bullion Creek, near Marysvale, July 23, 1905, *Rydberg & Carlton 7065* (type, in herb. N. Y. Bot. Gard.); also Big Cottonwood Cañon, June 28, *6390*, *6371*, and *6532*; Mount Barette, July 26, *7238*; near Alta, July 10, 1883, *Leonard 177*; Central Utah, 1875, *Parry 36*; Wahsatch Mountains, Aug., 1869, *S. Watson 488*, in part.

CORRECTION

Mertensia cana Rydb. nom. nov.

Mertensia canescens Rydb. Bull. Torrey Club **31**: 640. 1904. Not *Mertensia canescens* Kaulf. 1824.

Professor T. D. A. Cockerell has called my attention to the fact that my *Mertensia canescens* is antedated by *M. canescens* Kaulf., a fern.

NEW YORK BOTANICAL GARDEN.

INDEX TO AMERICAN BOTANICAL LITERATURE

(1909)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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Allen, J. A. Recommendations regarding the treatment of genera without species, etc. Science II. **30**: 596, 597. 29 O 1909.

Anderson, H. A. The algae of the Ithaca marshes. Science II. **30**: 654. 5 N 1909.

Atkinson, G. F. A remarkable *Amanita*. Bot. Gaz. **48**: 283–293. *f. 1–8*. 21 O 1909.

Amanita calyptroderma Atkinson & Ballen.

Benedict, R. C. Studies in the *Ophioglossaceae* — 3. Key to *Botrychium* in North America: group of *B. ternatum*. Torreya **9**: 197–200. 26 O 1909.

Bergen, J. Y. The modifiability of transpiration in young seedlings. Bot. Gaz. **48**: 275–282. *f. 1–4*. 21 O 1909.

Black, C. A. The development of the imbedded antheridium in *Dryopteris stipularis* (Willd.) Maxon and "*Nephrodium molle*." Bull. Torrey Club. **36**: 557–571. *pl. 26–28*. 30 O 1909.

Bordner, J. S. The influence of traction on the formation of mechanical tissue in stems. Bot. Gaz. **48**: 251–274. 21 O 1909.

Britton, N. L. Report on a visit to the Royal Gardens, Kew, and to the British Museum of Natural History, London, England. Jour. N. Y. Bot. Gard. **10**: 221–224. O 1909.

Broadhurst, J. Fasciation in the Japanese honeysuckle. Torreya **9**: 208, 209. 26 O 1909.

Brown, N. E. *Cercus amecamensis.* Curt. Bot. Mag. IV. **5**: *pl. 8277.* O 1909.

Brown, W. H. The embryo sac of *Habenaria.* Bot. Gaz. **48**: 241–250. *f. 1–12.* 21 O 1909.

Butters, F. K. The seeds and seedling of *Caulophyllum thalictroides.* Minnesota Bot. Stud. **4**: 11–32. *pl. 4–10.* 10 Je 1909.

Clements, F. E., & Shantz, H. LeR. A new genus of bluegreen algae. Minnesota Bot. Stud. **4**: 133–135. *pl. 20.* 10 Je 1909.
Eucapsis alpina gen. et sp. nov., from Colorado.

Clute, W. N. A checklist of North American fernworts. Fern Bull. **15**: 120–127. [Ja] 1909.

C[lute], W. N. Rare forms of ferns — X. *Lycopodium alopecuroides adpressum polyclavatum.* Fern Bull. **17**: 45–48. Ap 1909.

Copeland, E. B. New or interesting Philippine ferns — IV. Philipp. Jour. Sci. **4**: Bot. 111–115. Je 1909.

Criddle, N. The so-called white wild oats and what they are. Ottawa Nat. **23**: 127, 128. 18 O 1909.

Davis, W. T. High-bush blueberries. Proc. Staten Island Assoc. **2**: 63, 64. 30 S 1909.

Fernald, M. L. *Fimbristylis Frankii* Steud., var *brachyactis* n. var. Rhodora **11**: 180. 29 S 1909.

Ganong, W. F. New normal appliances for use in plant physiology. V. Bot. Gaz. **48**: 301–305. *f. 1, 2.* 21 O 1909.

[Gibson, H. H.] American forest trees — 81. Black spruce, *Picea nigra* Link ; *Picea Mariana* Mill. Hardwood Record **29**[1]: 19, 20. 25 O 1909. [Illust.]

Goodlatte, A. R. Notes on the anatomy of *Parosela spinosa* (A. Gray) Heller. Bull. Torrey Club **36**: 573–582. *pl. 29.* 30 O 1909.

Greene, E. L. Certain California *Thalictra.* Muhlenbergia **5**: 128–131. 23 O 1909.
Includes 3 new species.

Harper, R. M. Some coastal plain plants in the Piedmont region of Georgia. Bull. Torrey Club **36**: 583–593. 30 O 1909.

Harris, J. A. A short method of calculating the coefficient of correlation in the case of integral variates. Biometrika **7**: 214–218. 22 O 1909.

Harris, J. A. Note on variation in *Adoxa.* Biometrika **7**: 218–222. 22 O 1909.

Heller, A. A. Mule ears. Muhlenbergia **5**: 131, 132. 23 O 1909.
Wyethia mollis Gray.

Hickel, R. Notes pour servir à la détermination pratique des Abiétinées. Bull. Soc. Dendr. France **1909**: 13–21. 15 F 1909.

Hitchcock, A. S. Stable nomenclature practically unattainable. Science II. **30**: 597, 598. 29 O 1909.

Hone, D. S. The *Pezizales*, *Phacidiales*, and *Tuberales* of Minnesota. Minnesota Bot. Stud. **4**: 65–132. *pl. 14–19*. 10 Je 1909.

Hone, D. S. Two *Basidiomycetes* new to Minnesota: *Exobasidium mycetophilum* and *Cantharellus retirugus*. Minnesota Bot. Stud. **4**: 61–64. *pl. 11–13*. 10 Je 1909.

House, H. D. Studies in the North American *Convolvulaceae*—V. *Quamoclit*. Bull. Torrey Club **36**: 595–603. 30 O 1909.
Includes a new species, *Q. Langlassei* House, from Mexico.

Huber, J. Sur la découverte de deux Éricacées dans la plaine amazonienne. Bull. Soc. Bot. Genève II. **1**: 245–249. *f. 1, 2*. 30 Je 1909.
Two new species, *Leucothoë Duckei* and *Gaylussacia amazonica*.

Kirkwood, J. E. Desert scenes in Zacatecas. Pop. Sci. Mo. **75**: 435–451. [O] 1909. [Illust.]

Knowlton, C. H., & *others*. *Habenaria dilatata*, an omitted record. Rhodora **11**: 179, 180. 29 S 1909.

Kunze, R. E. *Echinocactus arizonicus* R. E. Kunze n. sp. Monats. Kakteenk. **19**: 149, 150, 151. 15 O 1909. [Illust.]

Leavitt, R. G. Seedlings and adventitious plants of *Drosera*. Torreya **9**: 200–203. 26 O 1909.

Macoun, J. M. Notes from the herbarium of the Geological Survey of Canada. Ottawa Nat. **23**: 121, 122. 18 O 1909.

McGregor, E. A. Two new spermatophytes from California. Bull. Torrey Club **36**: 605–609. *f. 1–3*. 30 O 1909.
Oxytheca Abramsii McGregor and *Malacothrix arachnoidea* McGregor.

Moore, A. H. A color form of *Carum Carvi*. Rhodora **11**: 178. 29 S 1909.

Nash, G. V. A new grass endemic in Jamaica. Torreya **9**: 209, 210. 26 O 1909.
Danthonia Shrevei Britton.

Nash, G. V. The cycad collection. Jour. N. Y. Bot. Gard. **10**: 225–227. *pl. 70*. O 1909.

Peirce, G. J. The possible effect of cement dust on plants. Science II. **30**: 652–654. 5 N 1909.

Penhallow, D. P. An account of certain noteworthy features in the habitat of *Rhodora*. Rhodora **11**: 173–177. 29 S 1909.

Quehl, L. *Mamillaria ceratites* Quehl n. sp. Monats. Kakteenk. **19**: 155, 156. 15 O 1909. [Illust.]

Ramaley, F. The silva of Colorado — IV. Forest formations and forest trees. Univ. Colorado Studies **6**: 249–281. *f. 1–34.* [My] 1909.

Rosendahl, C. O. Embryo-sac development and embryology of *Symplocarpus foetidus*. Minnesota Bot. Stud. **4**: 1–9. *pl. 1–3.* 10 Je 1909.

Rusby, H. H. Report on botanical work on the Pacific coast. Jour. N. Y. Bot. Gard. **10**: 227–234. O 1909.

Sampson, A. W., & Allen, L. M. Influence of physical factors on transpiration. Minnesota Bot. Stud. **4**: 33–59. 10 Je 1909.

Smith, J. D. Undescribed plants from Guatemala and other Central American Republics — XXXII. Bot. Gaz. **48**: 294–300. 21 O 1909.

Describes 14 new species distributed through 13 genera.

Stapf, O. *Laurelia serrata*. Curt. Bot. Mag. IV. **5**: *pl. 8279.* O 1909.

Sydow, P. & H. Monographia *Uredinearum* seu specierum omnium ad hunc usque diem cognitarum descriptio et adumbratio systematica, **2**[1]: 1–144. *pl. 1–5.* 20 S 1909.

Includes 2 new Brazilian species of *Uromyces*.

Underwood, L. M. *Pteridophyta*. N. Am. Fl. **16**: 1. 6 N 1909.

Underwood, L. M. *Marattiales*. N. Am. Fl. **16**: 15. 6 N 1909.

Underwood, L. M. *Marattiaceae*. N. Am. Fl. **16**: 17–23. 6 N 1909.

Includes *Marattia excavata* sp. nov.

Underwood, L. M., & Benedict, R. C. *Ophioglossaceae*. N. Am. Fl. **16**: 2–13. 6 N 1909.

Includes *Ophioglossum Harrisii* Underwood, sp. nov.

Underwood, L. M., & Benedict, R. C. *Ophioglossales*. N. Am. Fl. **16**: 1. 6 N 1909.

Underwood, L. M., & Maxon, W. R. *Filicales*. N. Am. Fl. **16**: 25. 6 N 1909.

Weingart, W. *Cereus Purpusii* Weing. spec. nov. Monats. Kakteenk. **19**: 150, 153–155. 15 O 1909.

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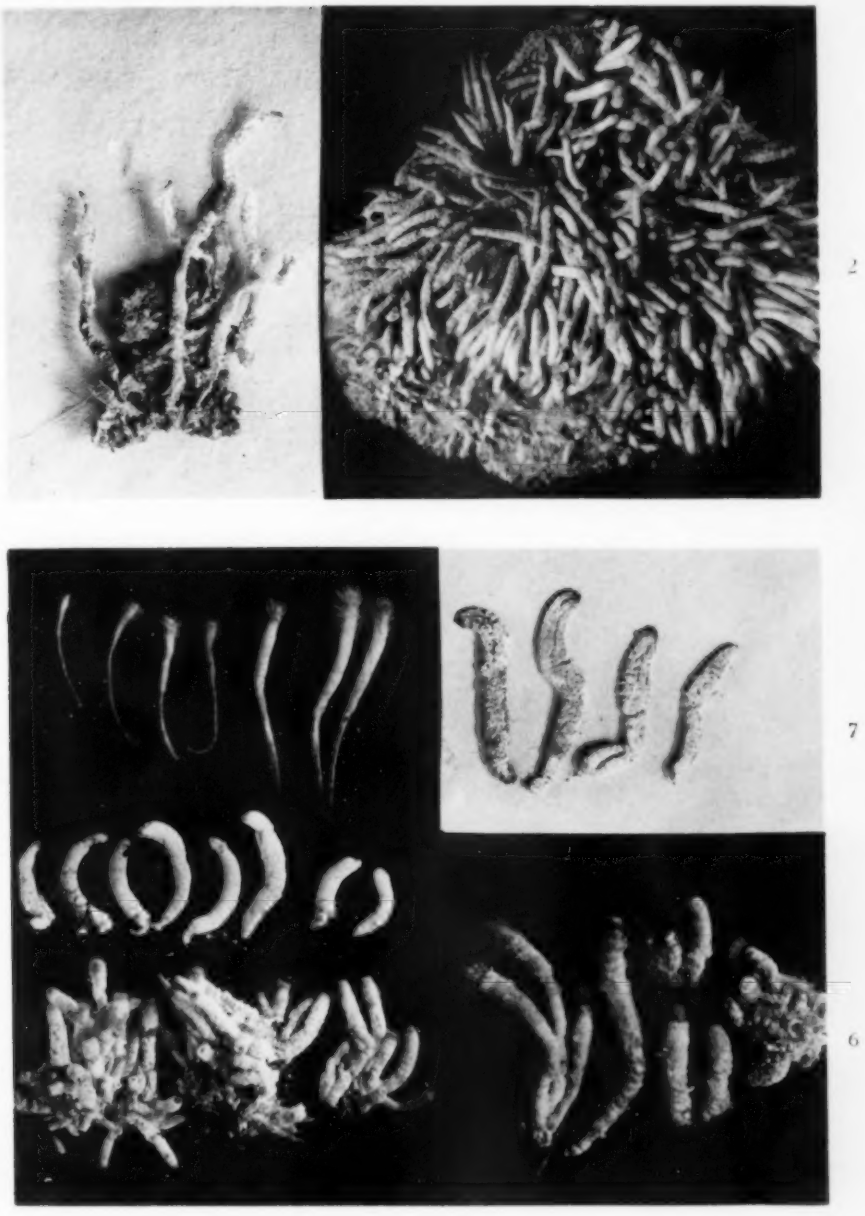

1. NEOMERIS DUMETOSA Lamour.
2. NEOMERIS ANNULATA Dickie
3. NEOMERIS STIPITATA M. A. Howe
4, 7. NEOMERIS VAN BOSSEAE M. A. Howe
5. NEOMERIS MUCOSA M. A. Howe
6. NEOMERIS COKERI M. A. Howe

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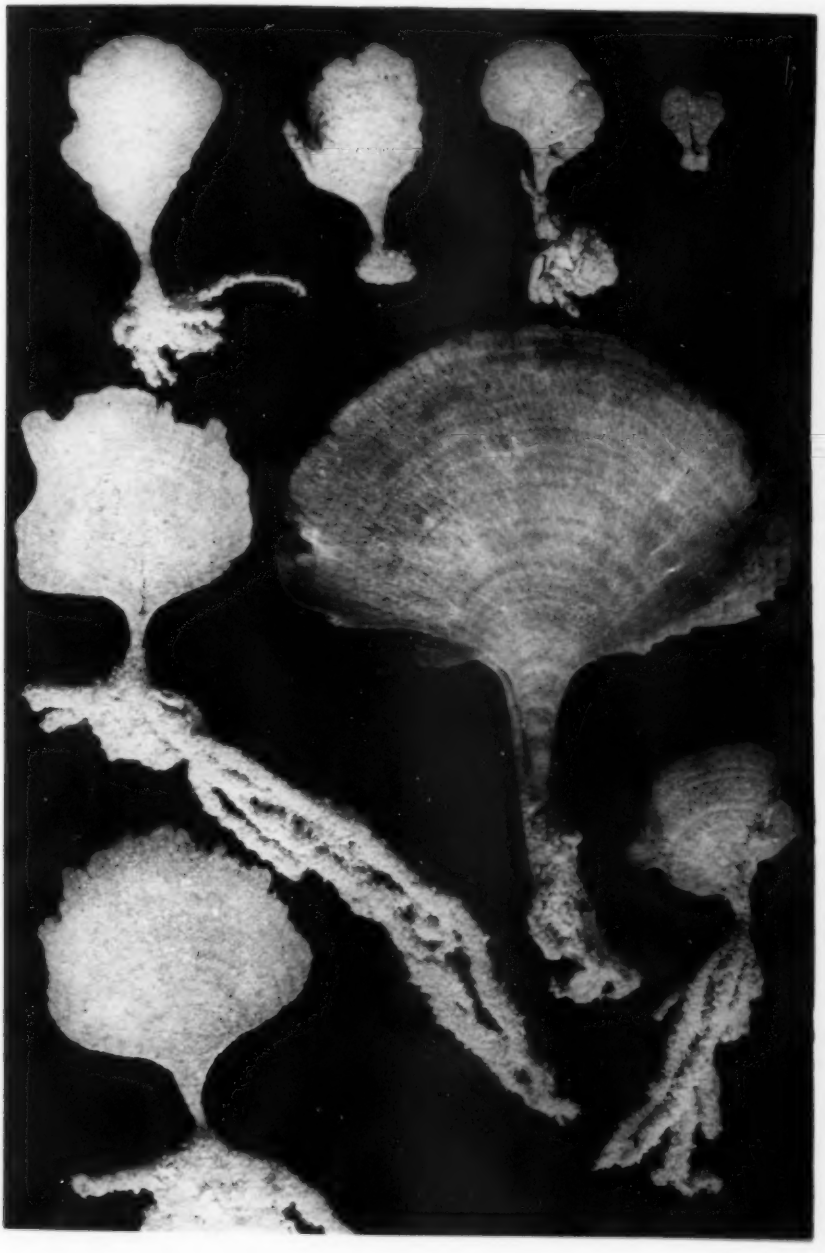
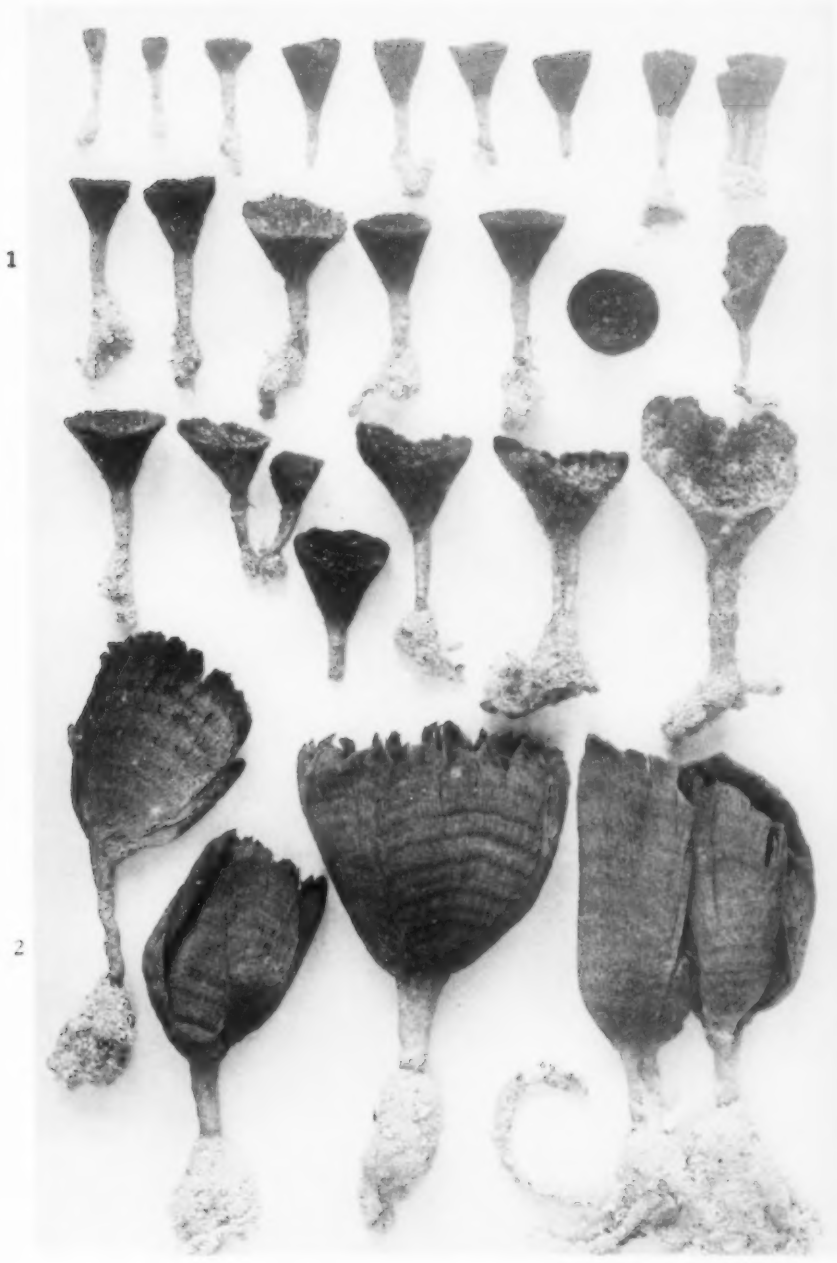


UDOTEA CONGLUTINATA (Ell. & Soland.) Lamour.

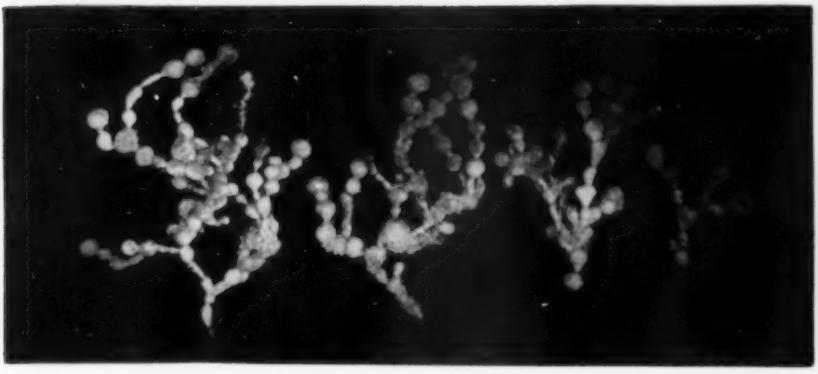
COCKAYNE, BOSTON



UDOTEA CYATHIFORMIS Decaisne

COCKAYNE BOSTON

1



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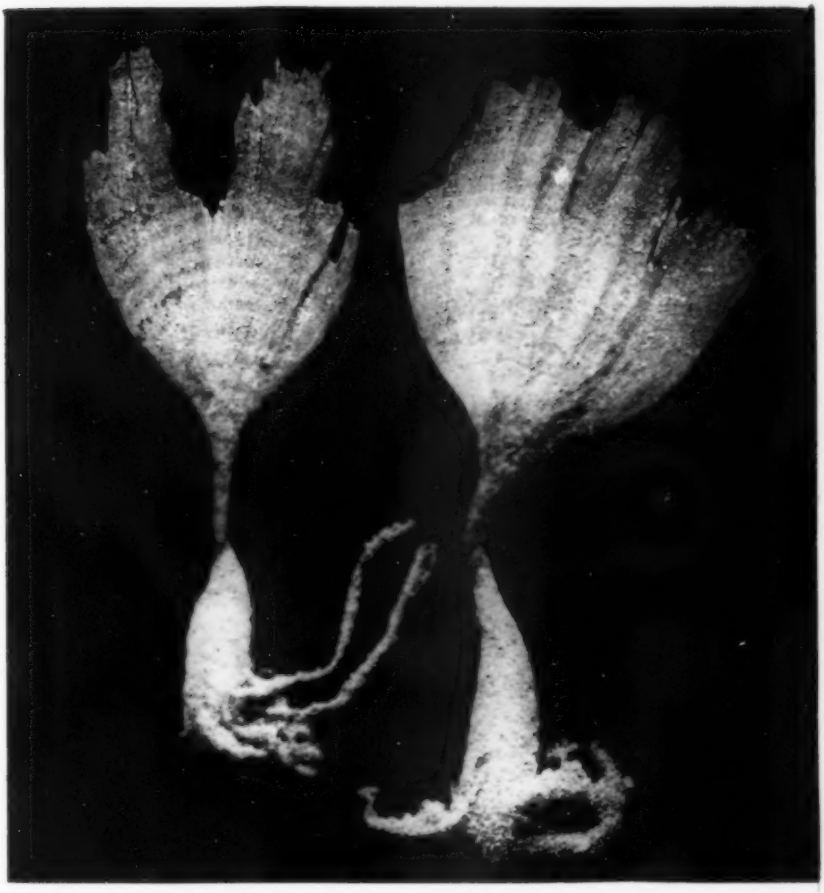
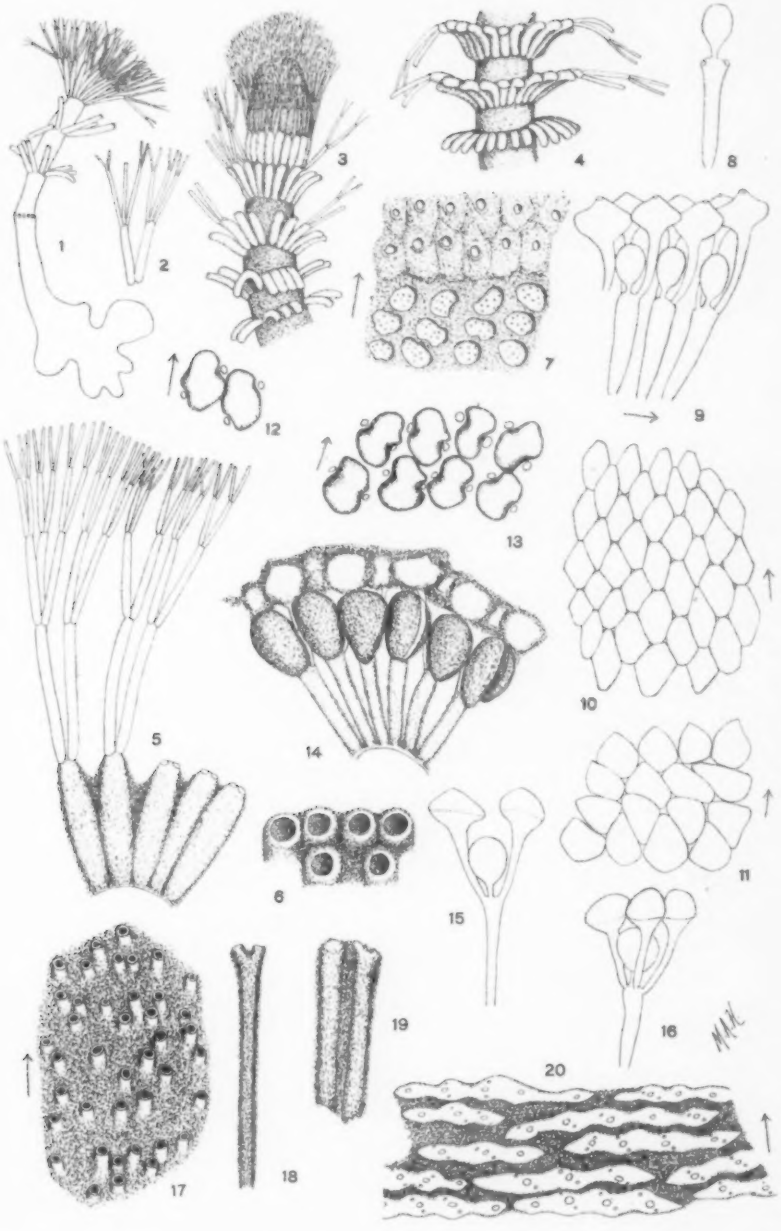


1. HALIMEDA LACRIMOSA M. A. Howe

2. UDOTEA SPINULOSA M. A. Howe

COCKAYNE, BOSTON



1-14. NEOMERIS MUCOSA M. A. Howe

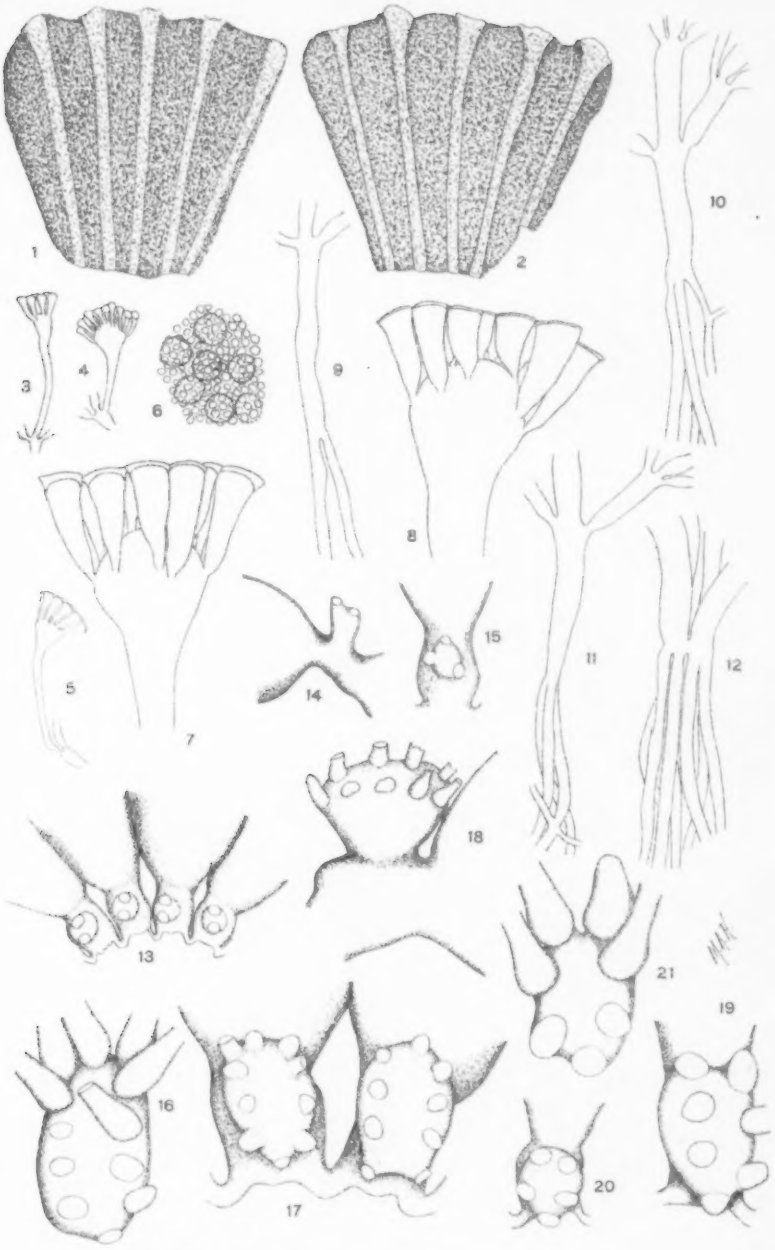
15-16. NEOMERIS STIPITATA M. A. Howe

17-19. NEOMERIS VAN BOSSEAE M. A. Howe

20. NEOMERIS DUMETOSA Lamour.

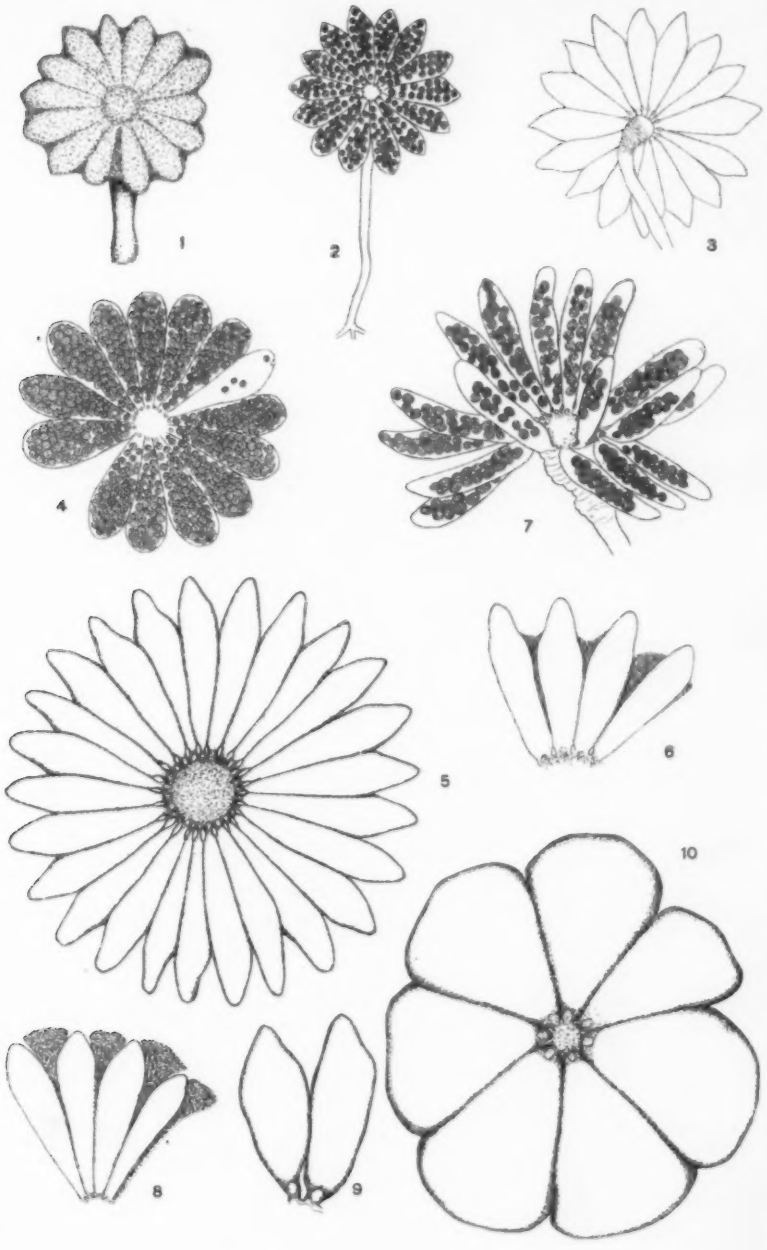
U of M

COCKAYNE, BOSTON.



1-2. NEOMERIS DUMETOSA Lamour.
3-12. HALIMEDA LACRIMOSA M. A. Howe
13-15. ACETABULUM PUSILLUM M. A. Howe
16-20. ACETABULUM POLYPHYSOIDES (Crouan) Kuntze
21. ACETABULUM POLYPHYSOIDES DELTOIDEUM M. A. Howe

COCKAYNE, BOSTON

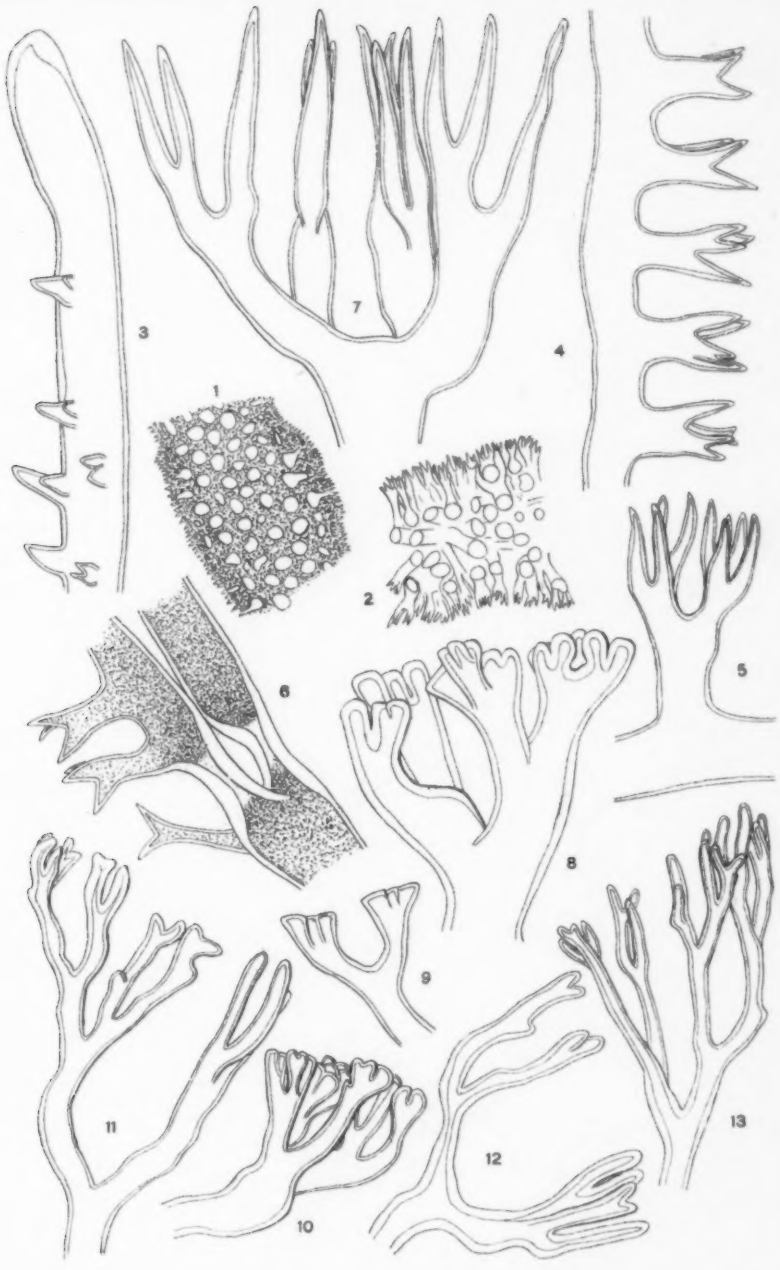


1-4. ACETABULUM PUSILLUM M. A. Howe

5-9. ACETABULUM POLYPHYSOIDES (Crouan) Kuntze

10. ACETABULUM POLYPHYSOIDES DELTOIDEUM M. A. Howe

COCKAYNE, BOSTON.

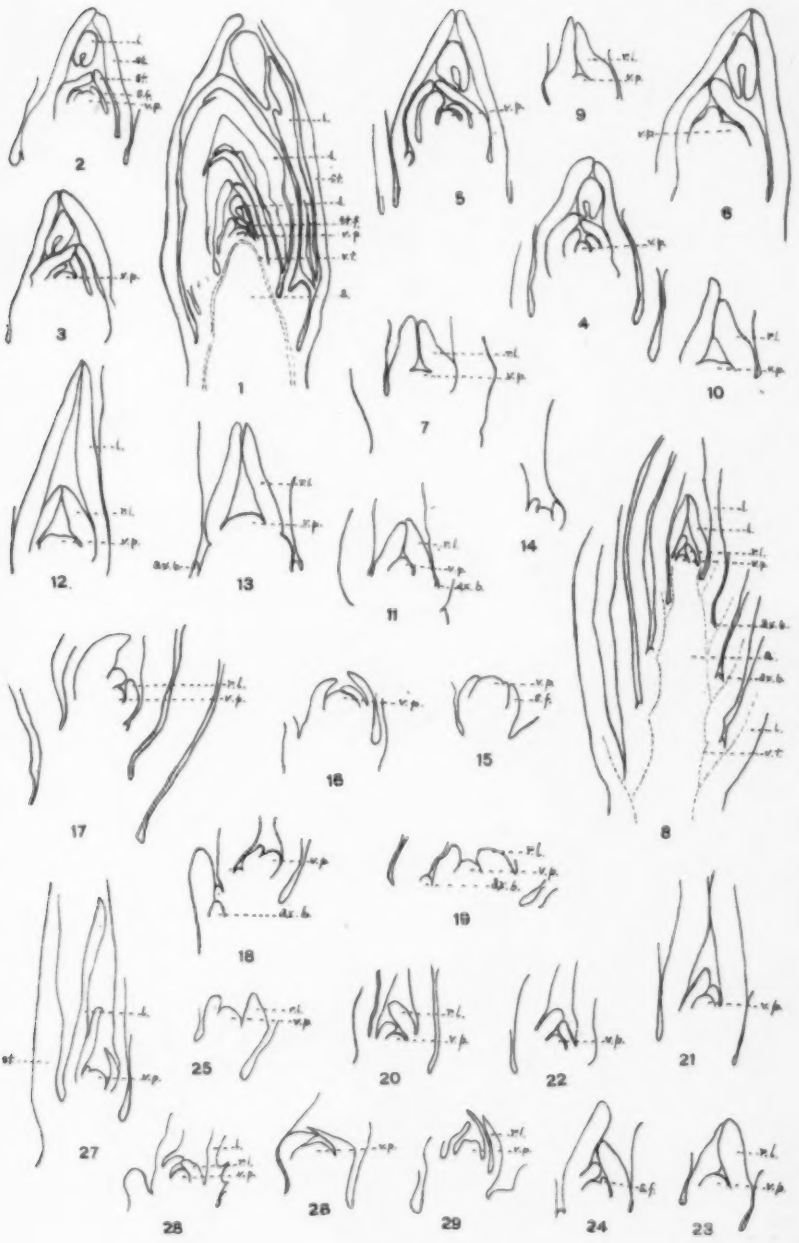


1-7. UDOTEA SPINULOSA M. A. Howe

8-10. UDOTEA CYATHIFORMIS Decaisne

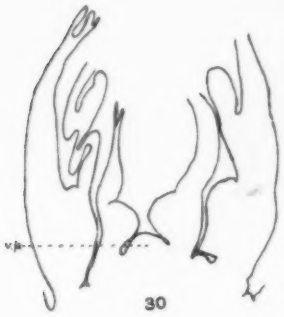
11-13. UDOTEA CONGLUTINATA (Ell. & Soland.) Lamour.

COCKAYNE, BOSTON.



MOORE, WINTER BUDS

COCKAYNE, BOSTON



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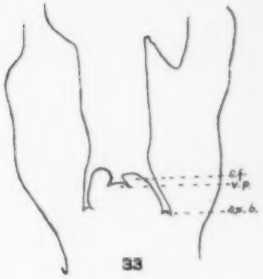

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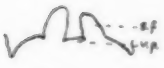

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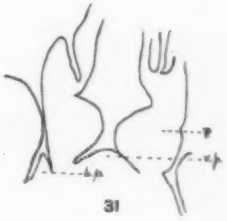

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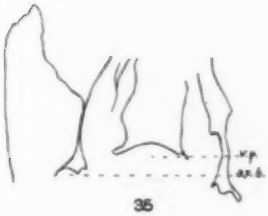

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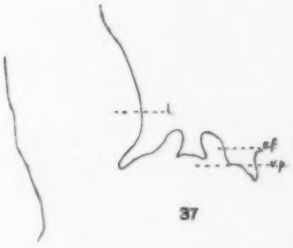

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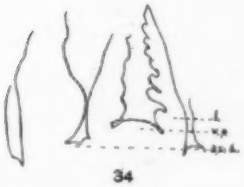

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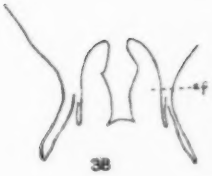

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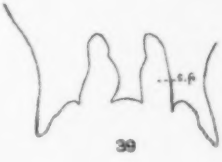

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MOORE, WINTER BUDS

COCKAYNE, BOSTON.

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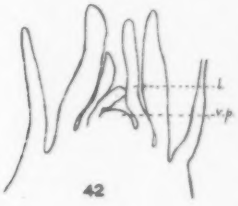

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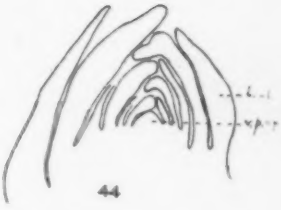

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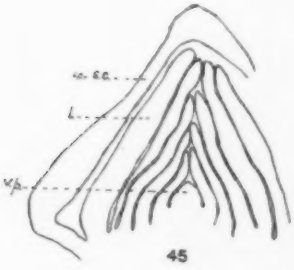

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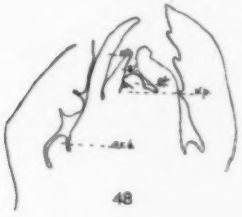

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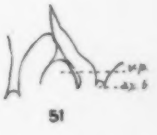

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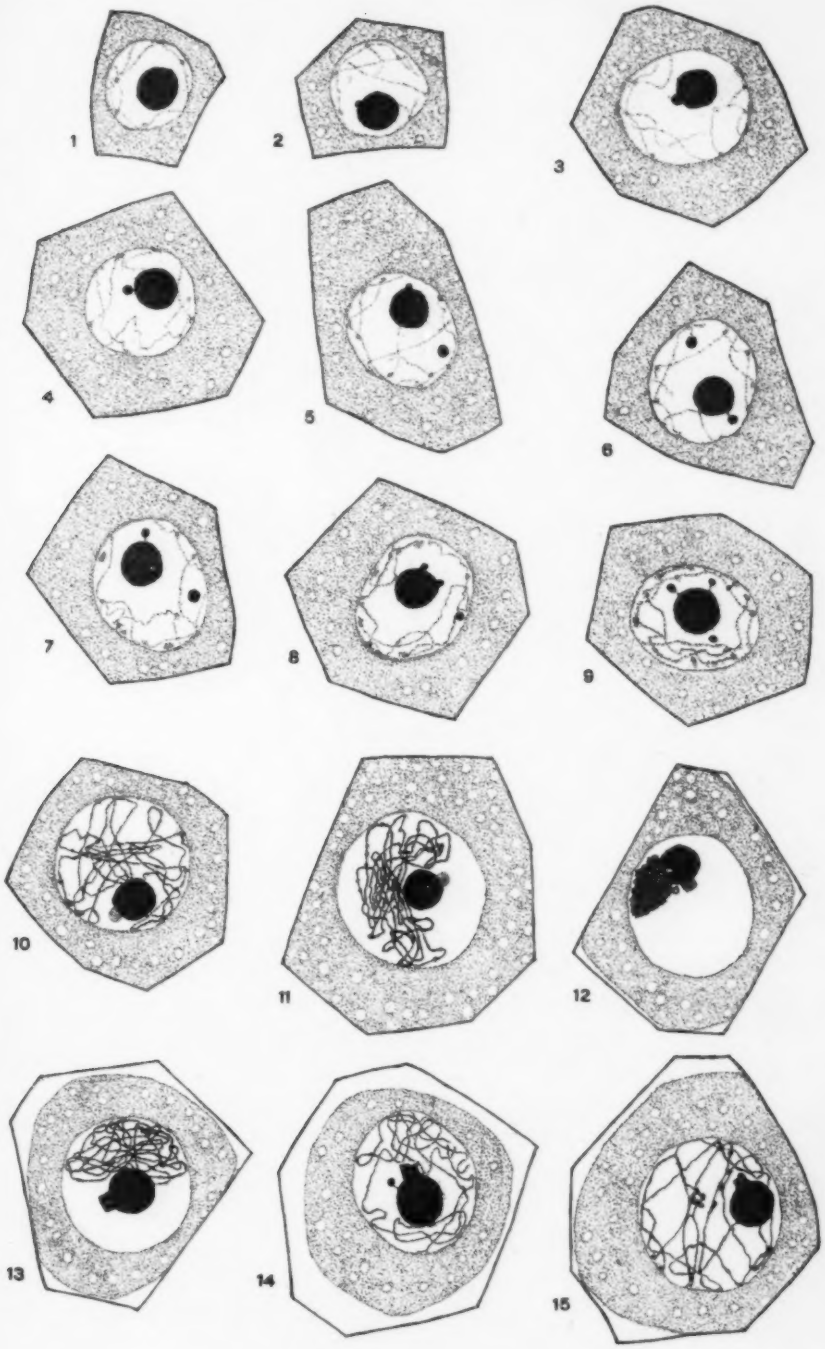
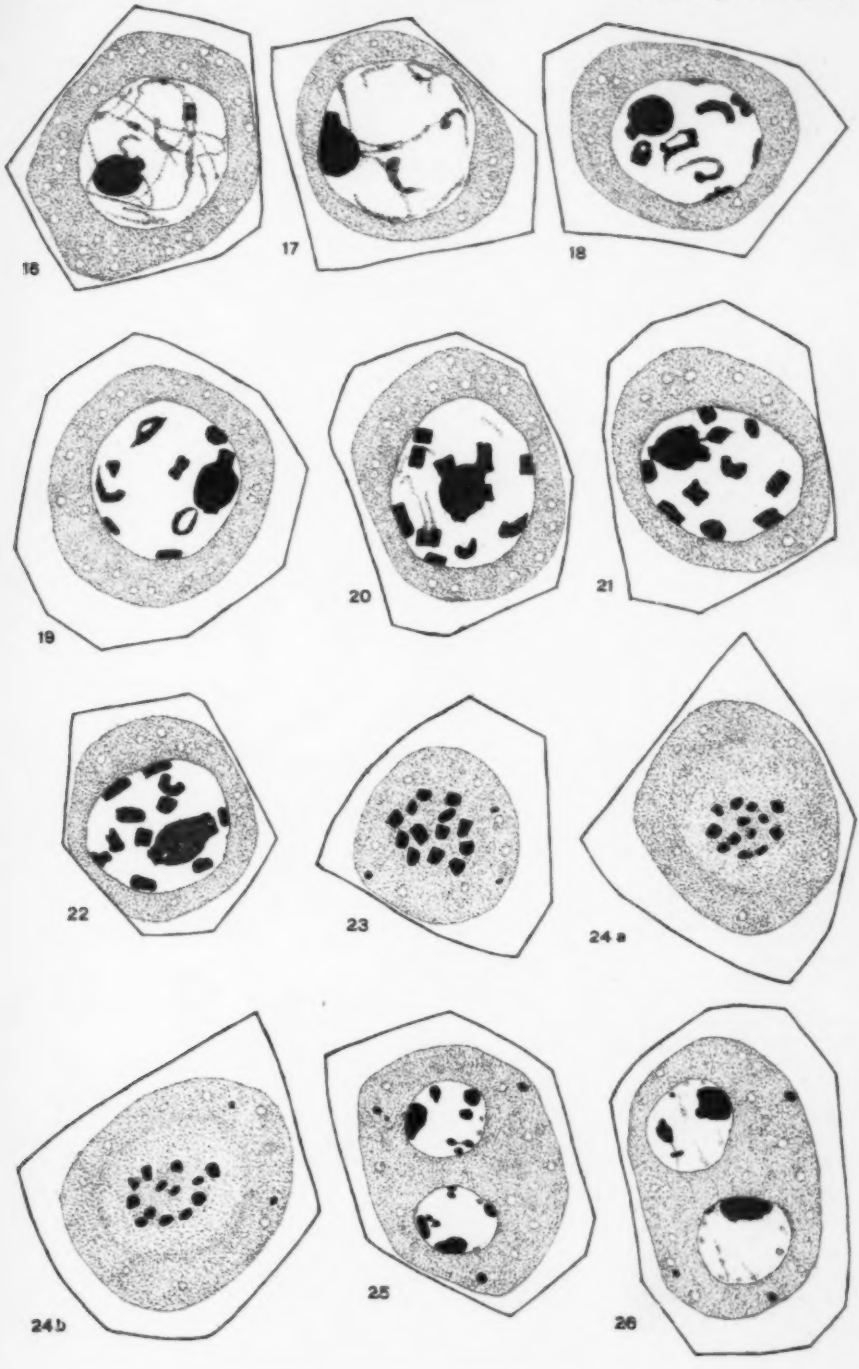
MOORE, WINTER BUDS



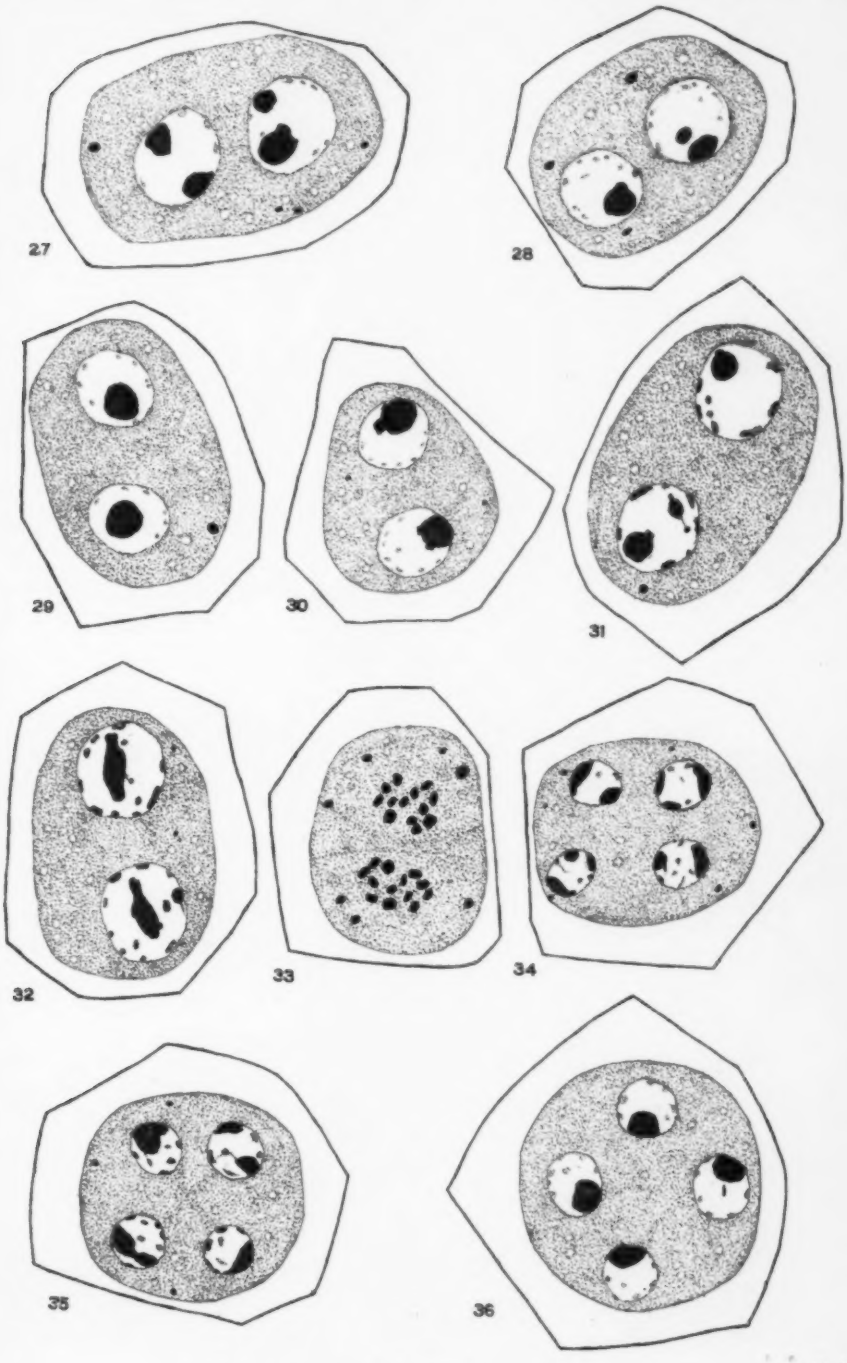
DARLING, SEX IN DIOECIOUS PLANTS

COCKAYNE, BOSTON.



DARLING, SEX IN DIOECIOUS PLANTS

COCKAYNE, BOSTON.



DARLING, SEX IN DIOECIOUS PLANTS

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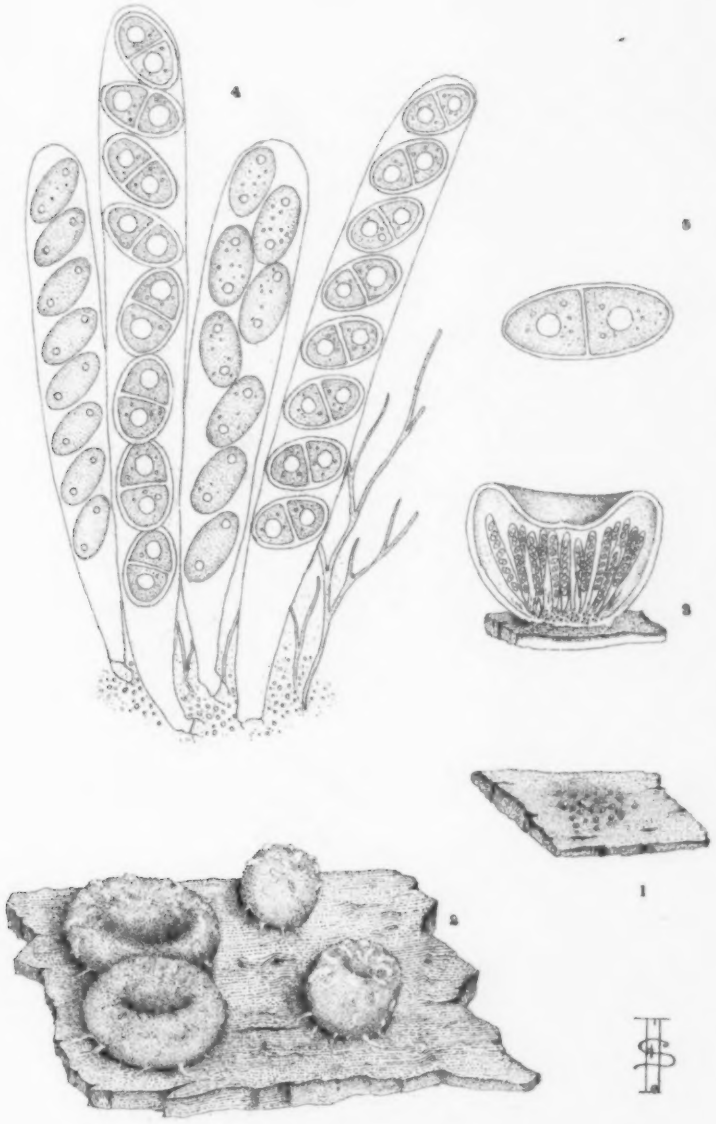
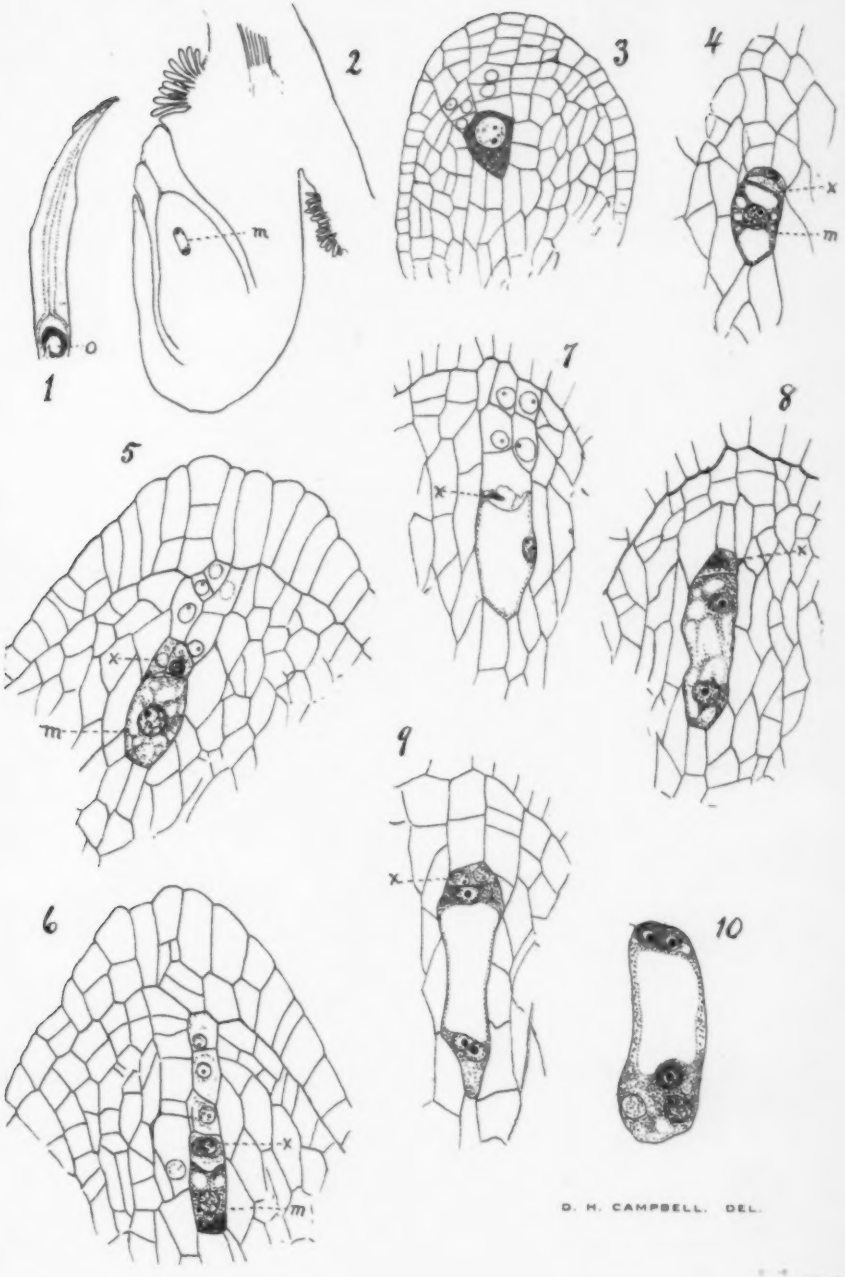


NECTRIA PEZIZA (Tode) Fr.

COCKAYNE, BOSTON



D. H. CAMPBELL, DEL.

CAMPBELL, THE EMBRYO-SAC OF PANDANUS

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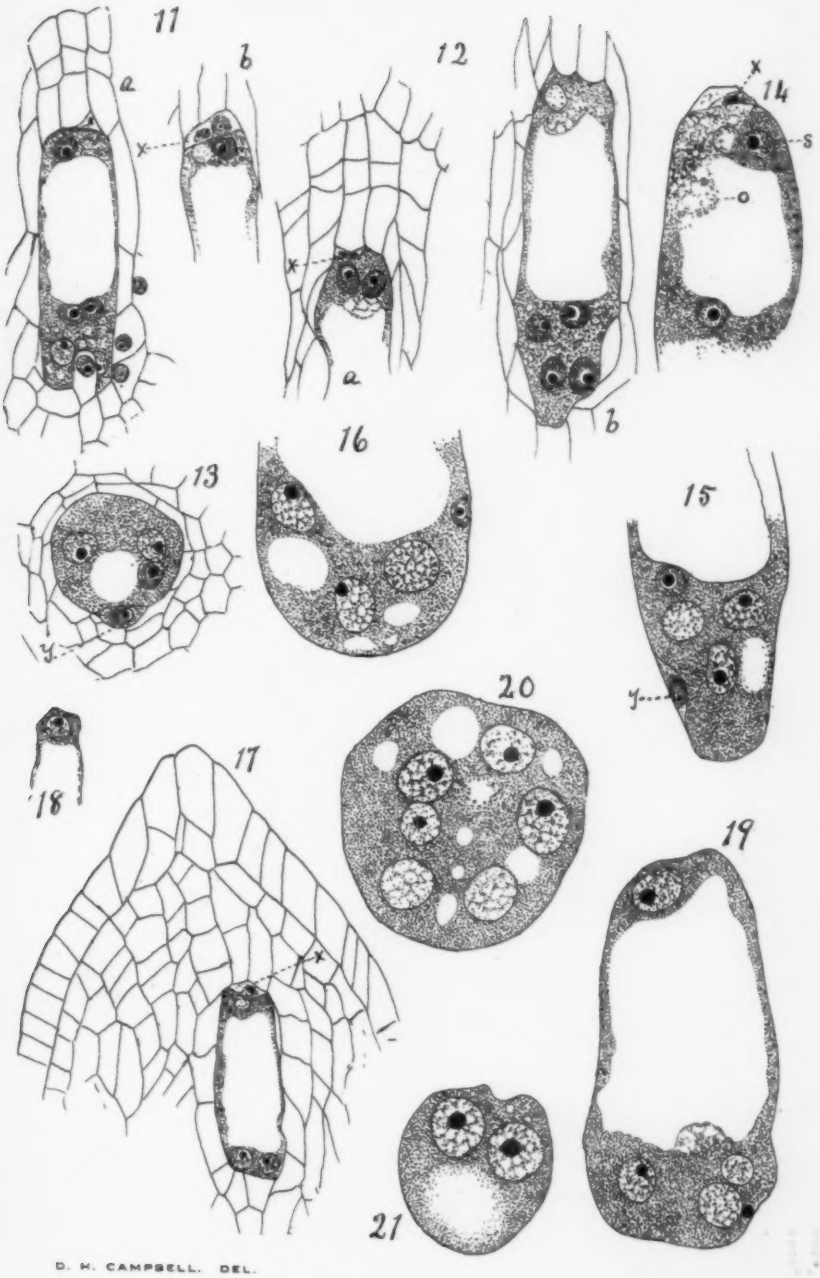
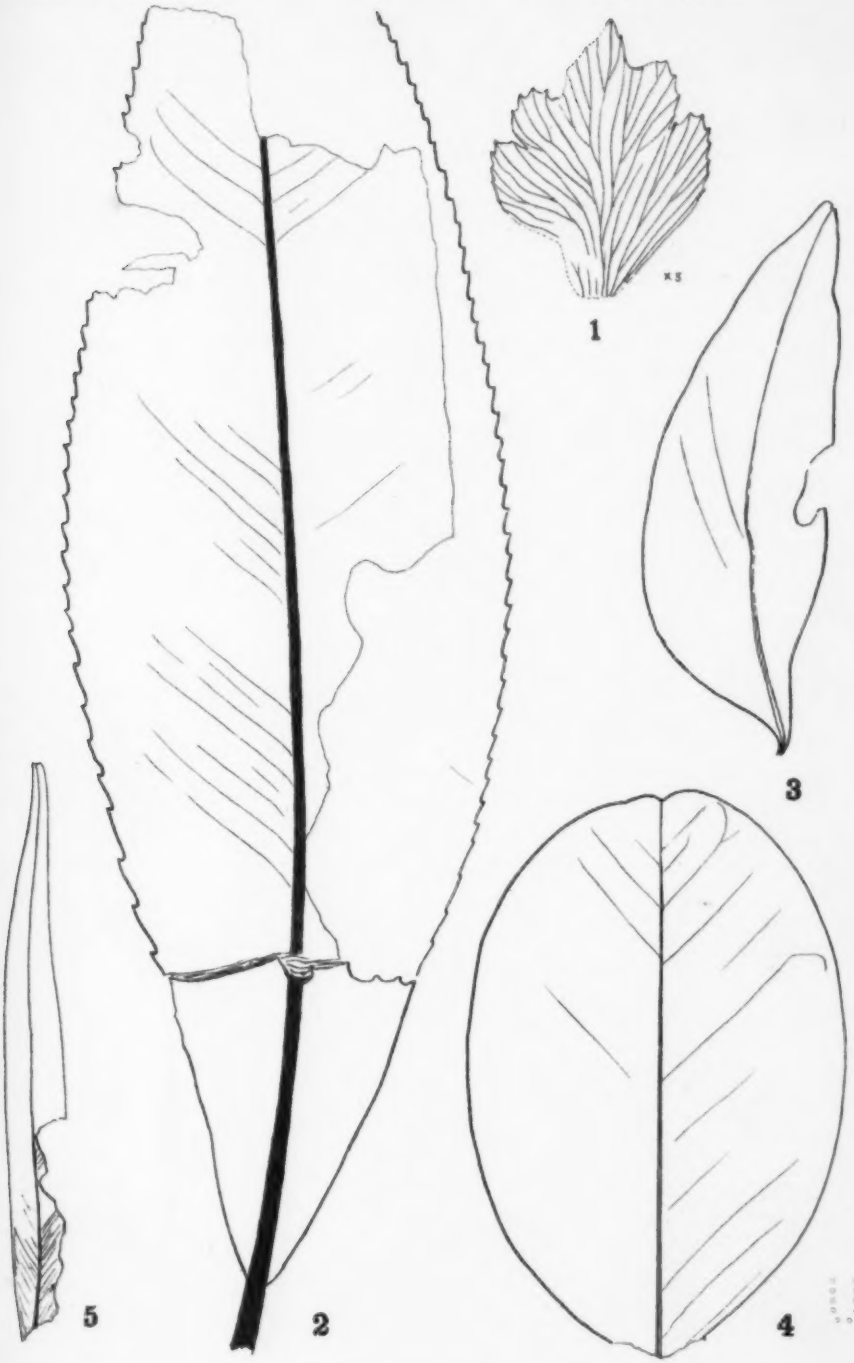


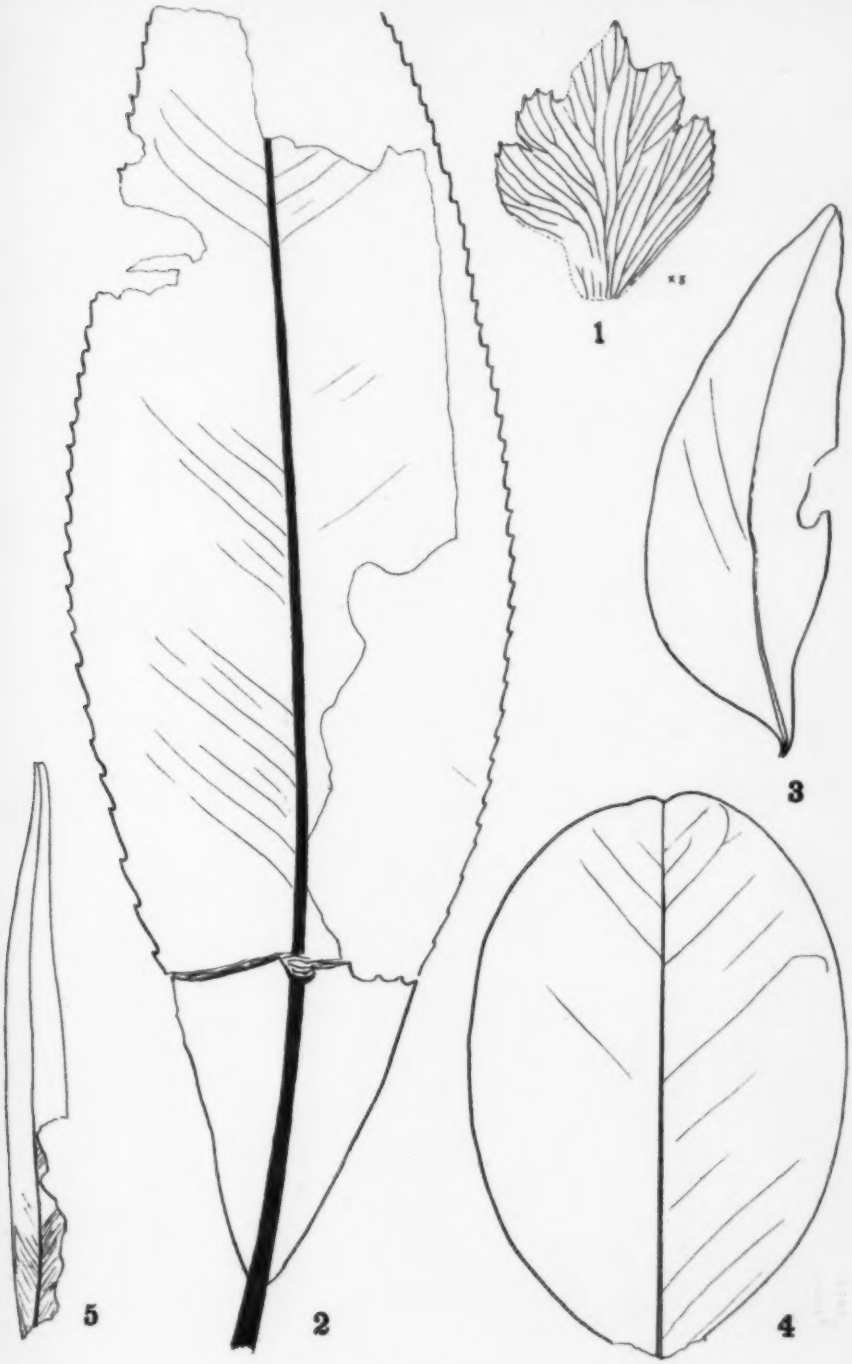
CAMPBELL, THE EMBRYO-SAC OF PANDANUS

COCKAYNE, BOSTON.



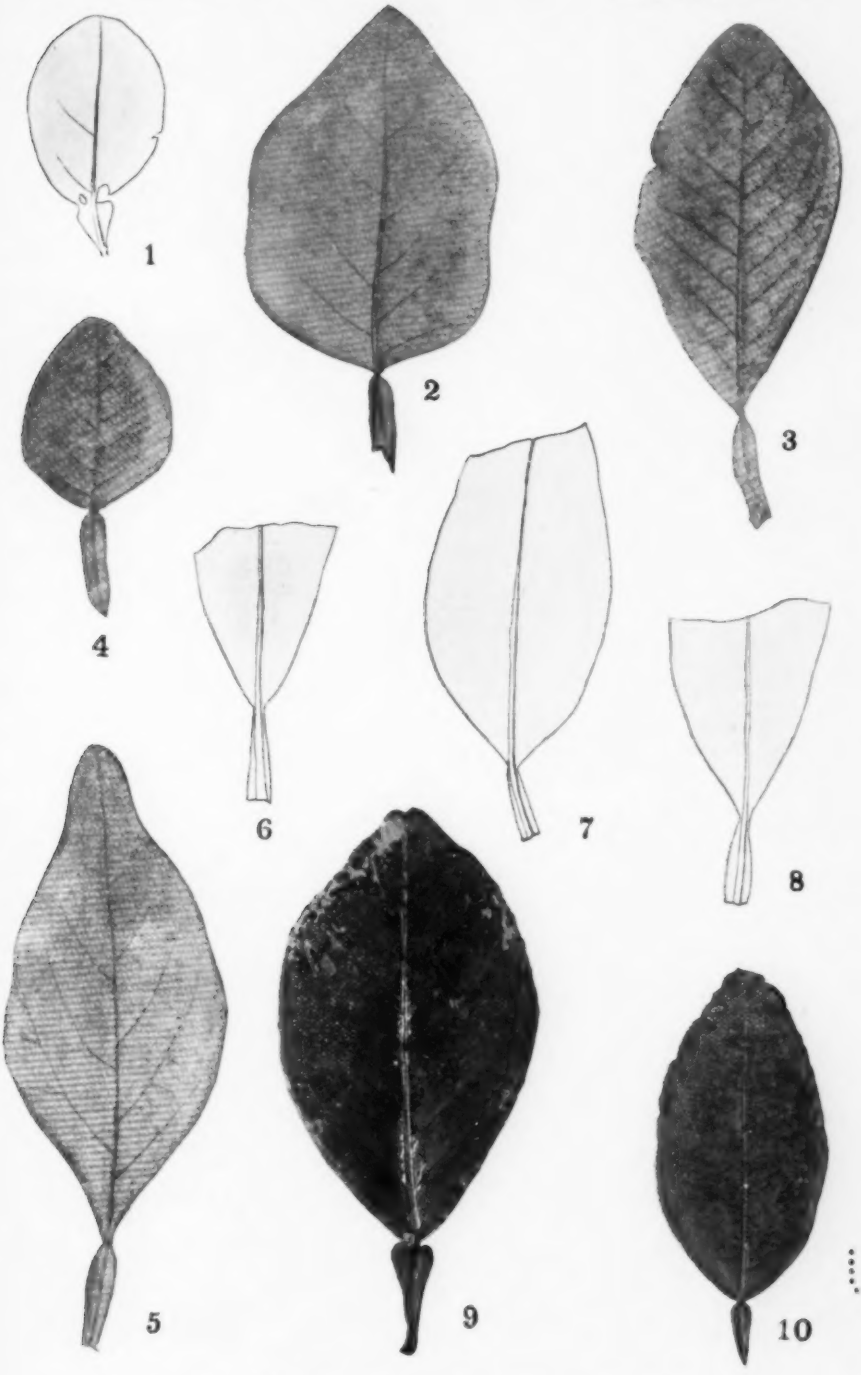
BERRY, MESOZOIC FLORA OF ATLANTIC COSTAL PLAIN

COCKAYNE, BOSTON.



BERRY, MESOZOIC FLORA OF ATLANTIC COSTAL PLAIN

COCKAYNE, BOSTON.



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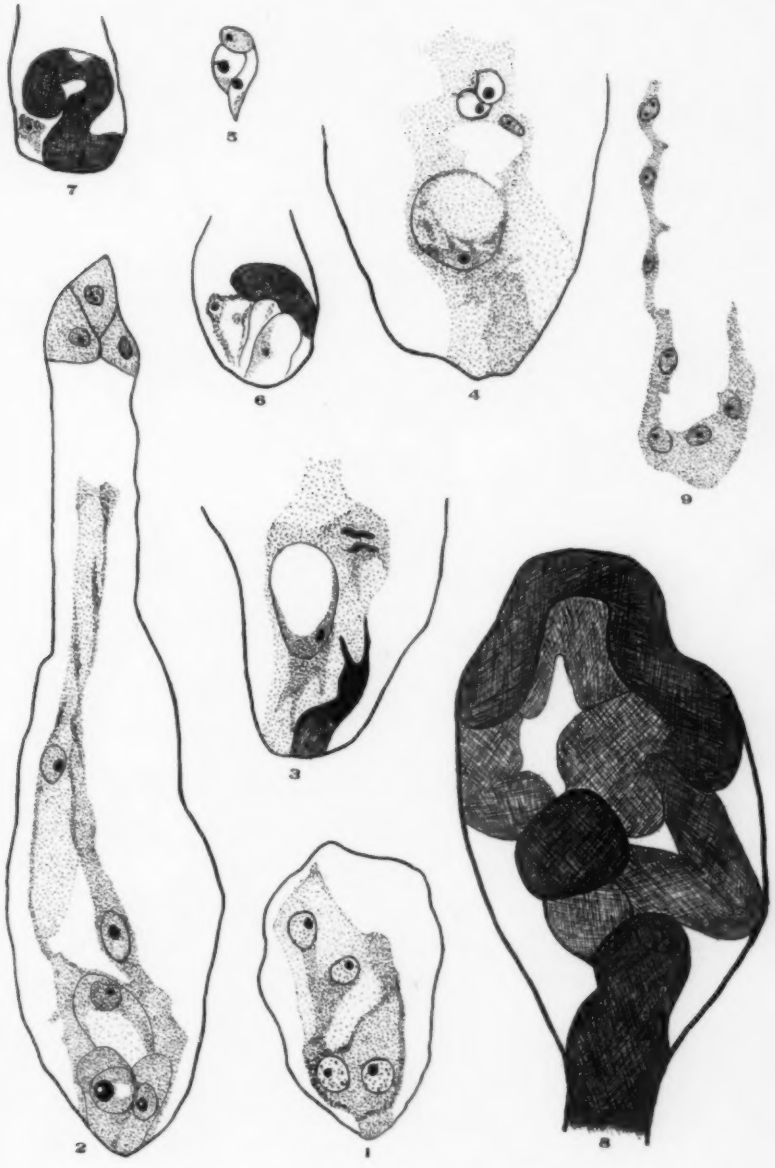

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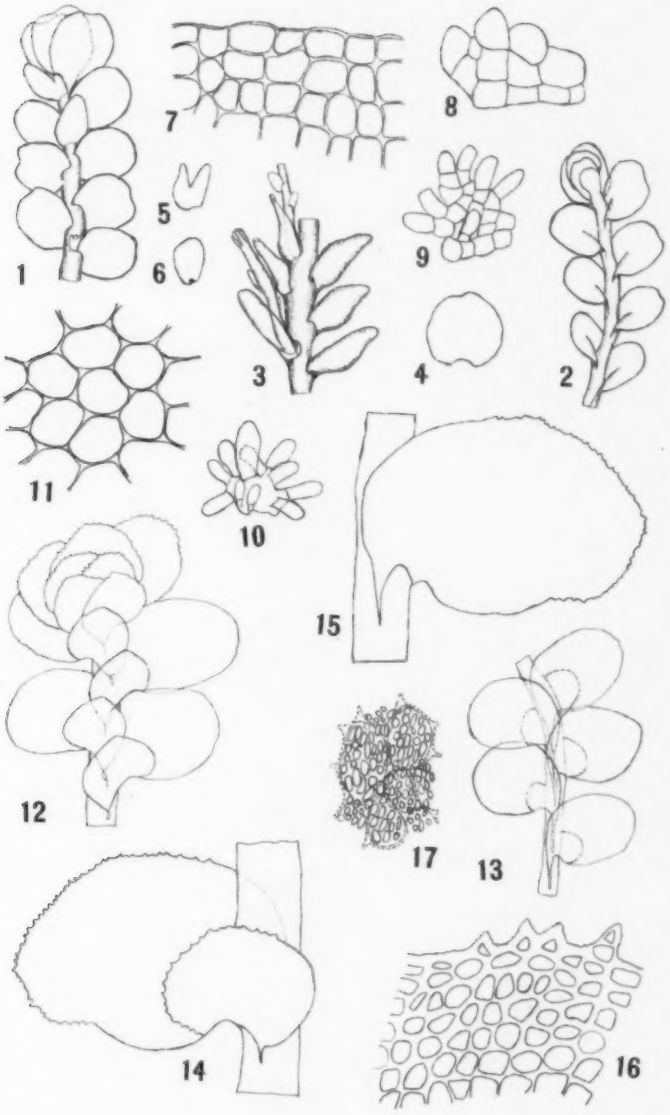
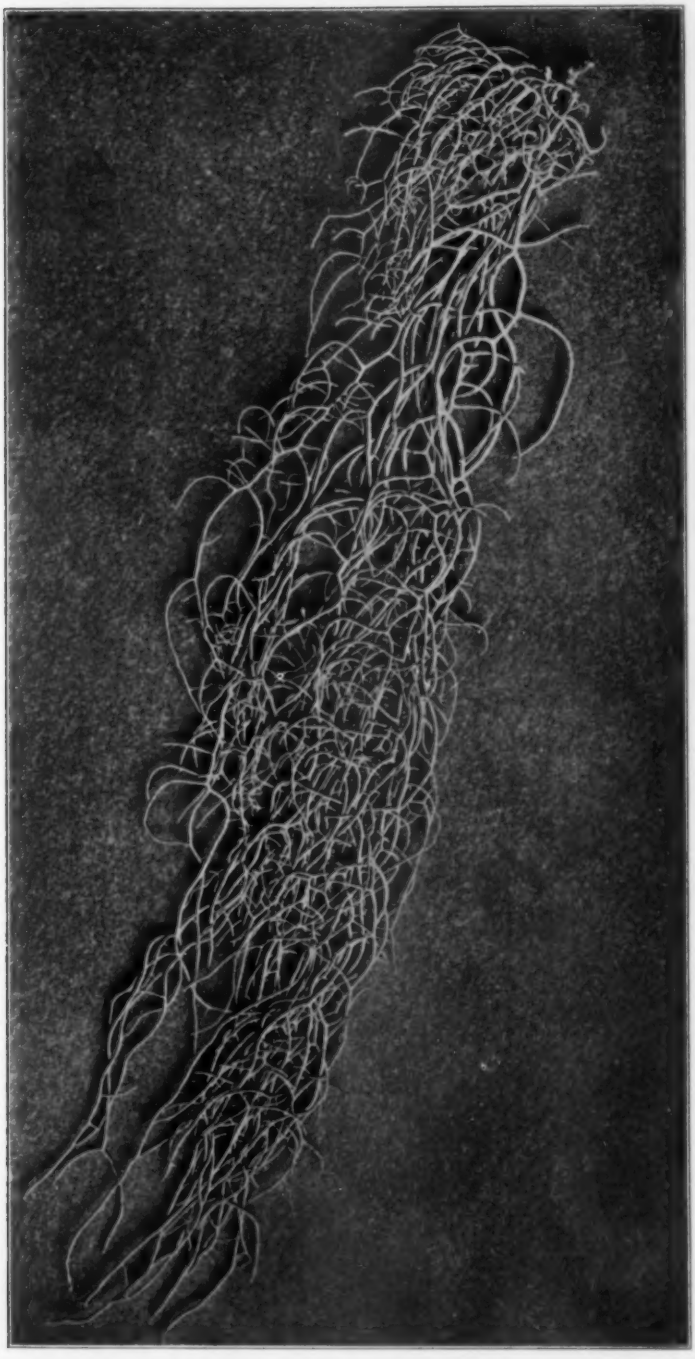


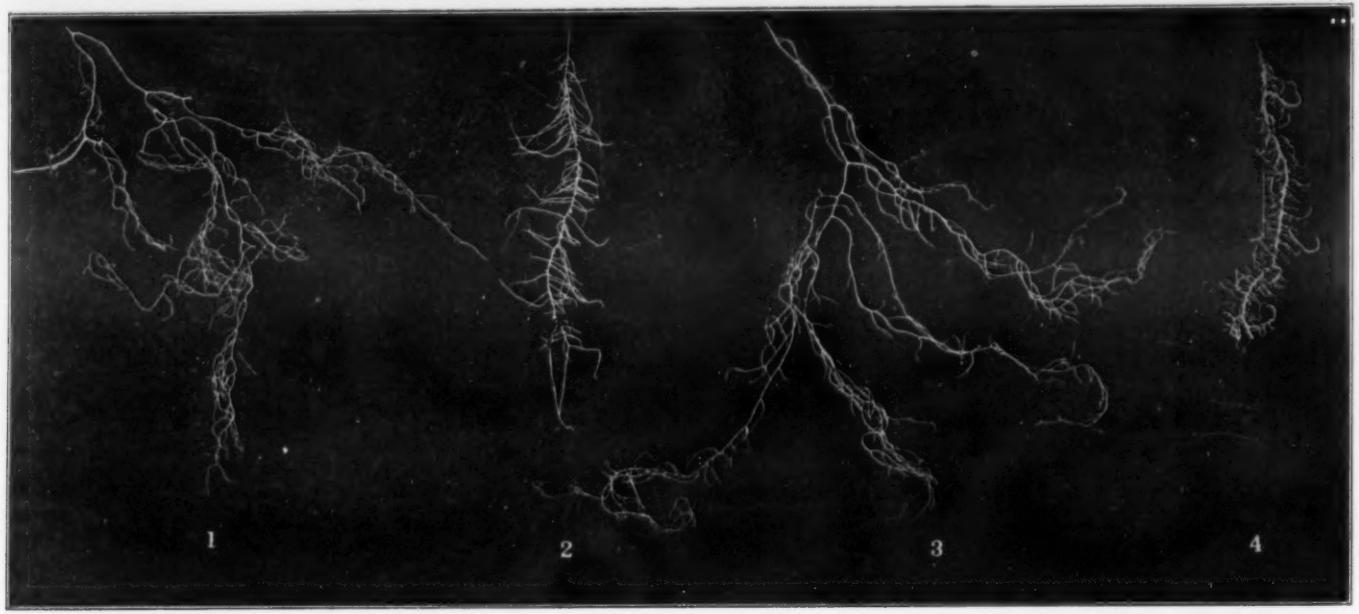
1-11. JUNGERMANNIA ALLENII L. Clark

12-17. SCAPANIA PALUDOSA PAPILLOSA K. Müll. Frib.

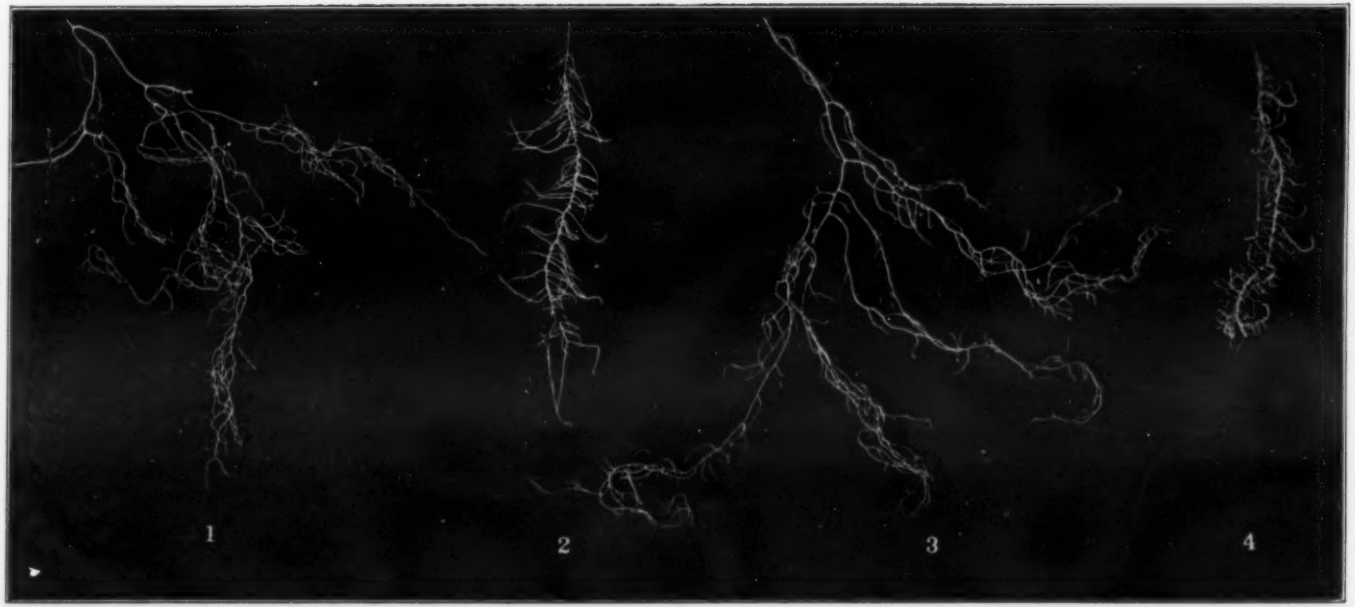
COCKAYNE, BOSTON.



USNEA BARBATA CERATINA Schaer.



1. USNEA CAVERNOSA Tuck.
2. USNEA LONGISSIMA Ach.
3. USNEA TRICHODEA Ach.
4. USNEA ANGULATA Ach.



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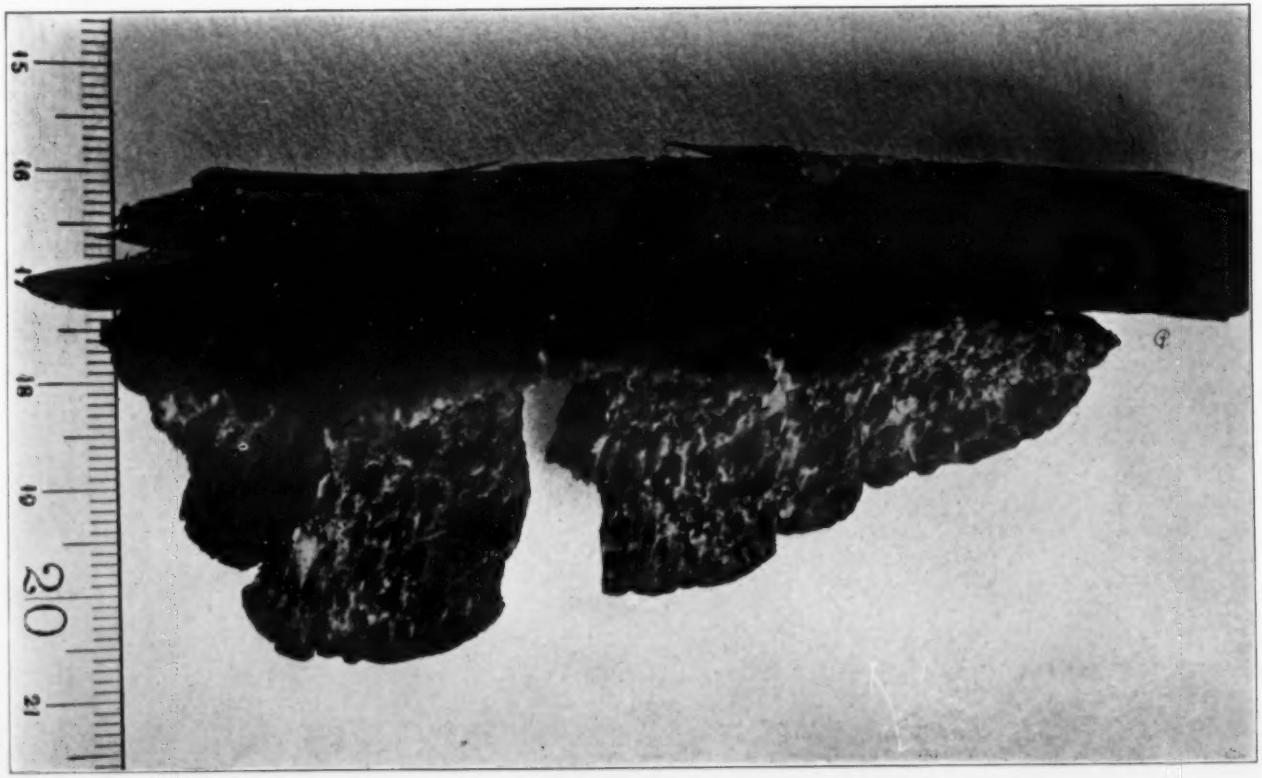
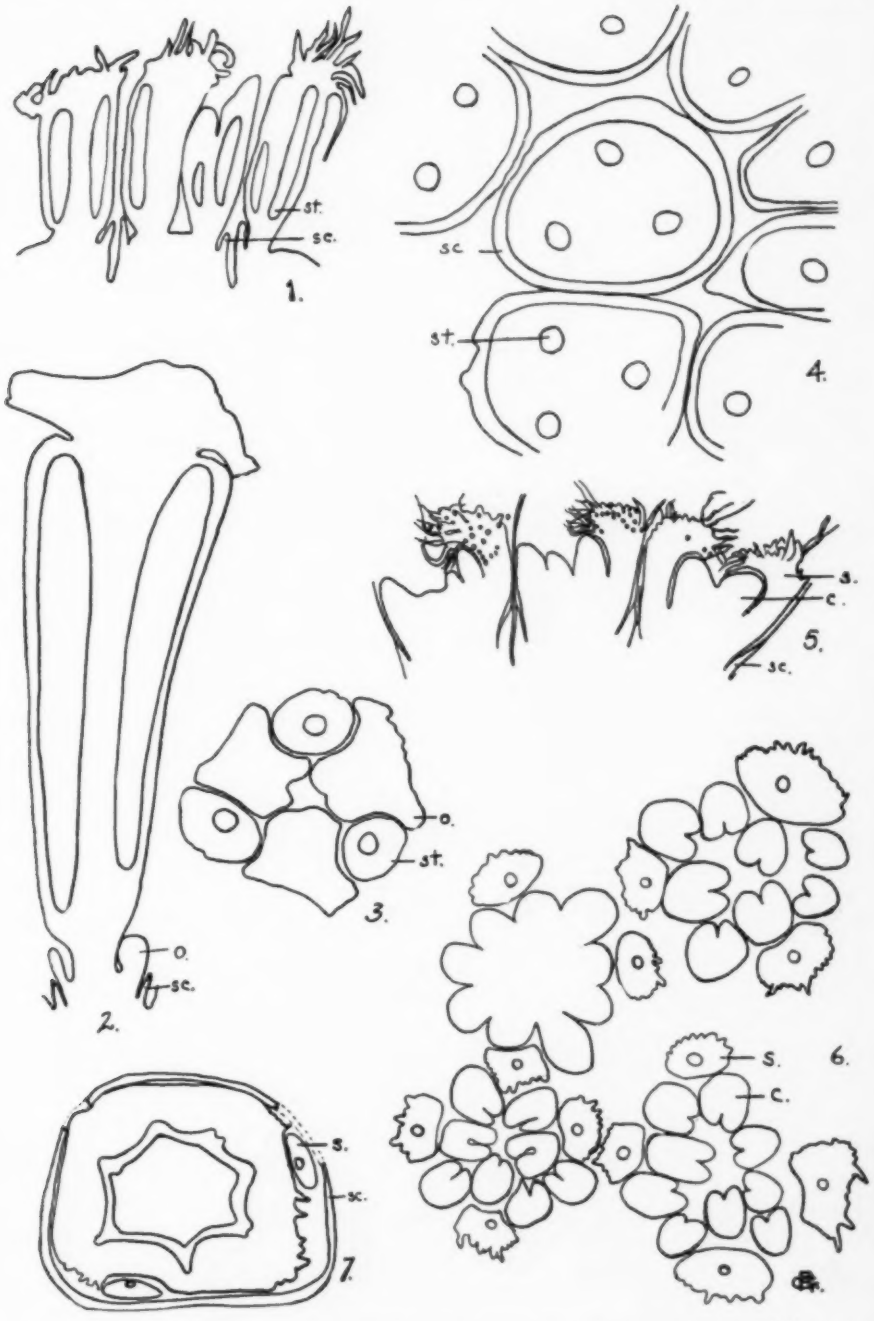


STECCHERINUM BALLOUII Banker



GRIGGS, CHARACTERS OF THE PLATANACEAE

BLACK, THE IMBEDDED ANTHERIDIUM IN DRYOPTERIS STIPULARIS, ETC.

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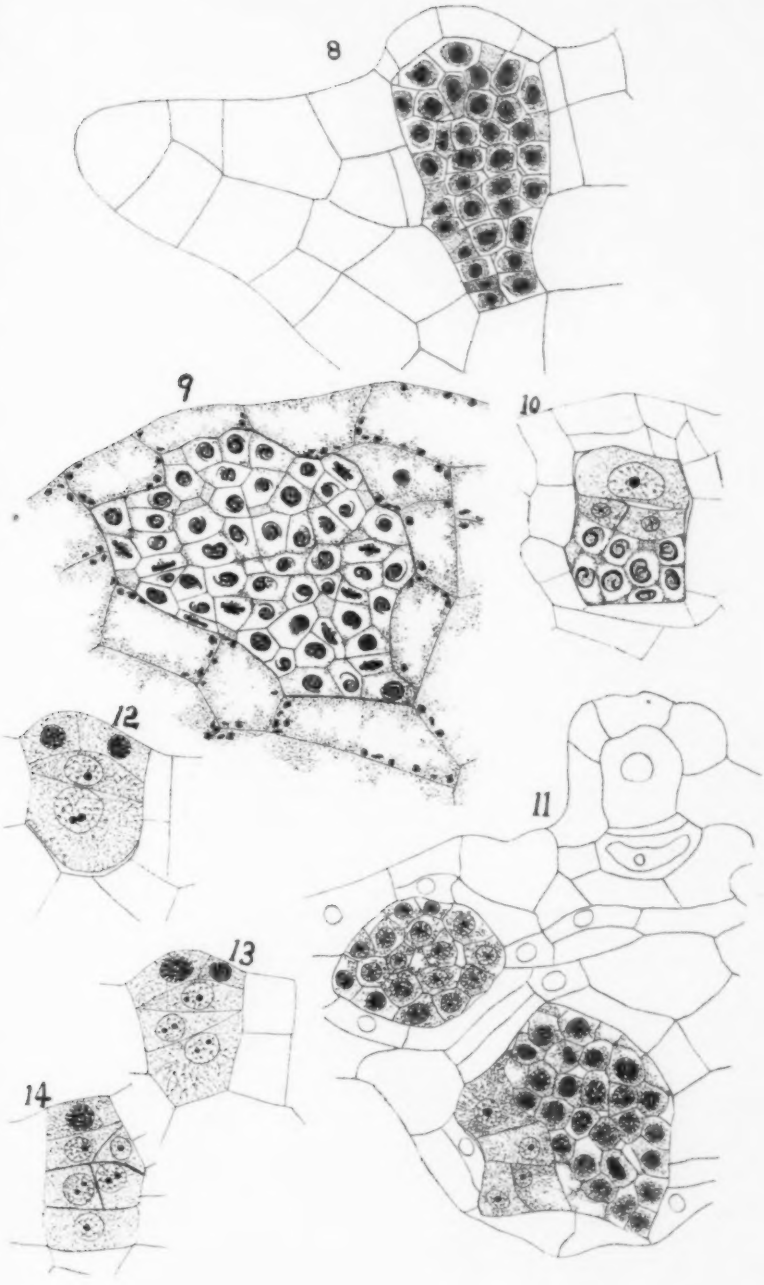
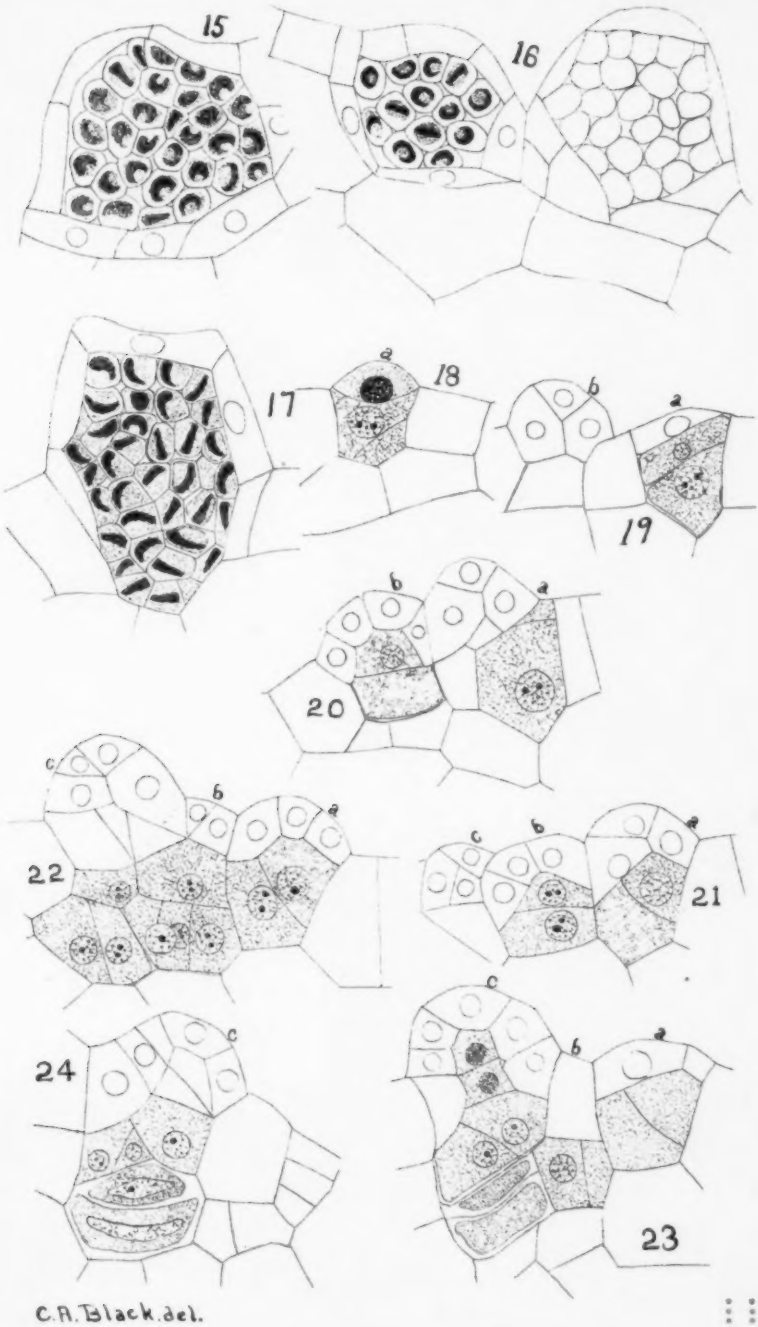
COCKAYNE, BOSTON



BLACK, THE IMBEDDED ANTHERIDIUM IN DRYOPTERIS STIPULARIS, ETC.

U of M

COCKAYNE, BOSTON



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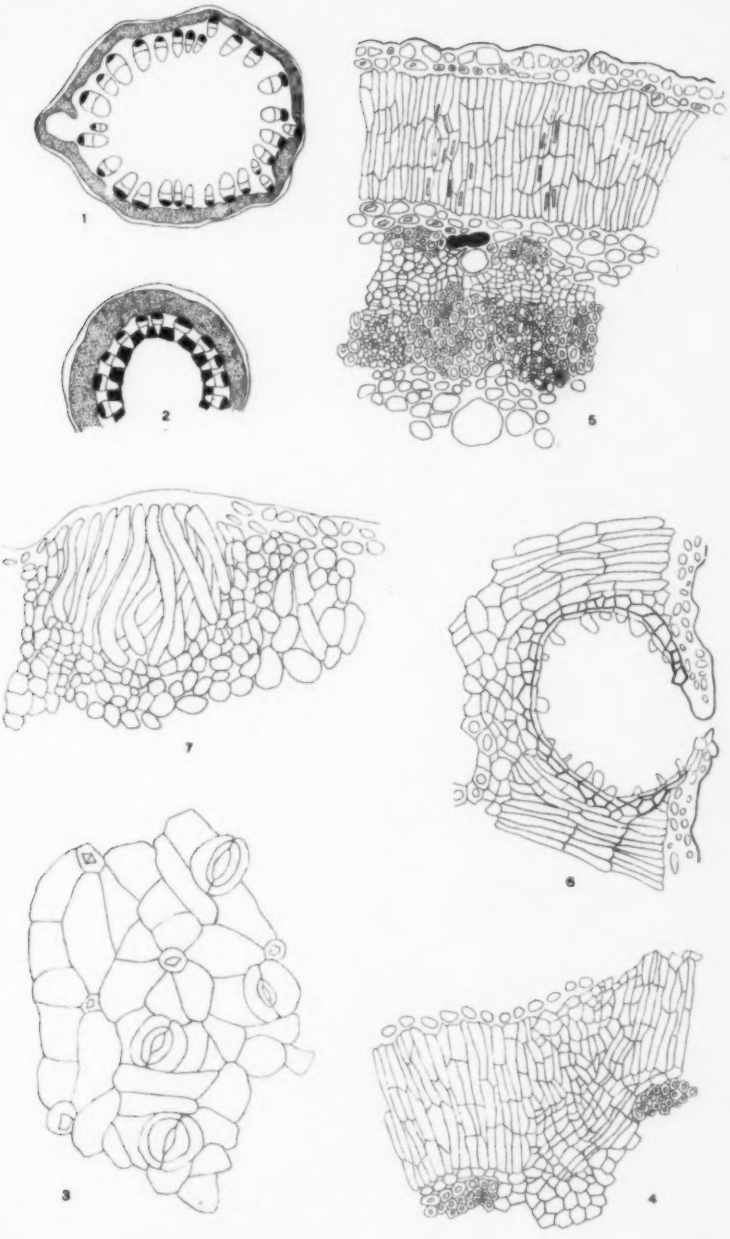
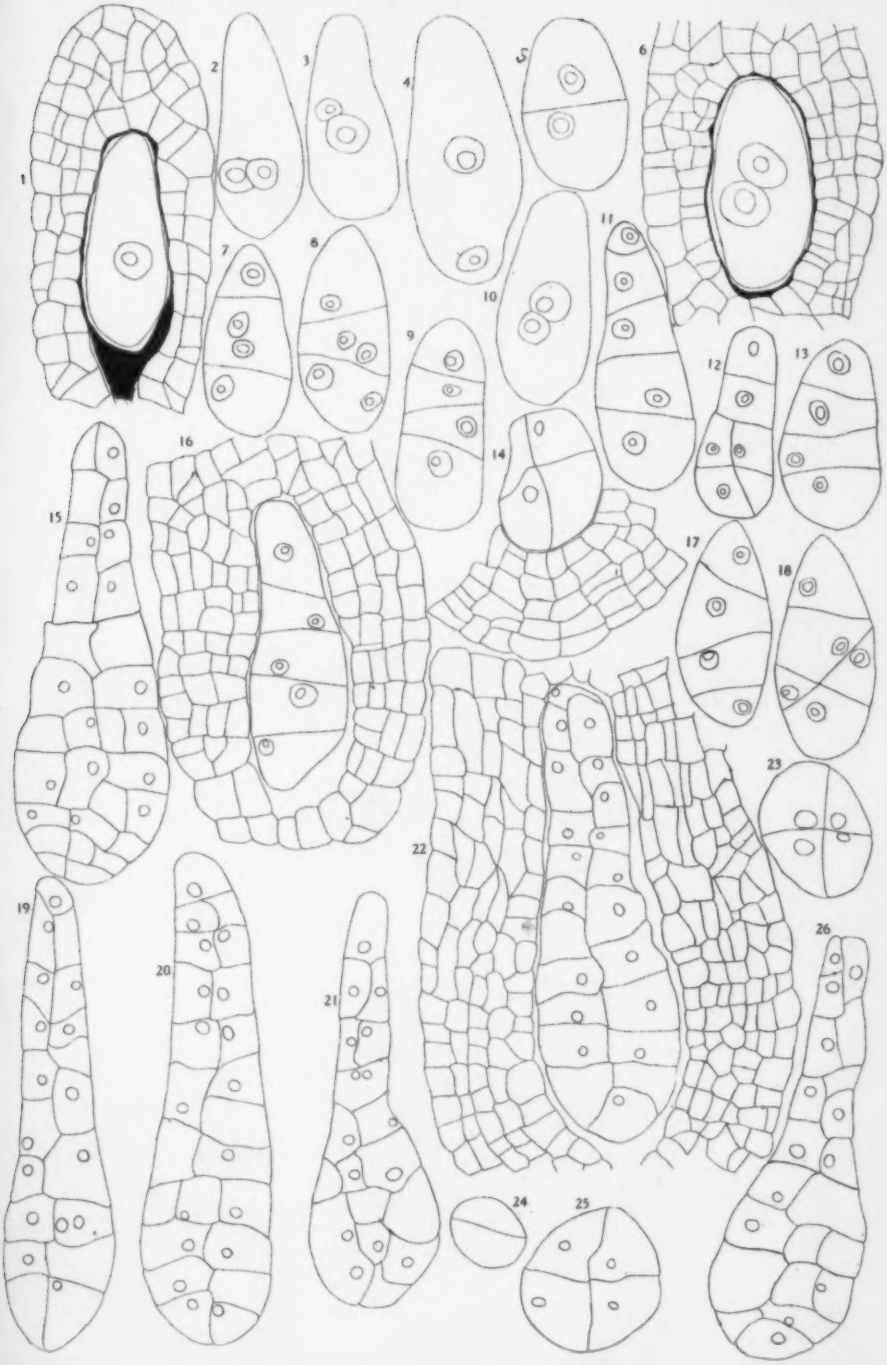
COCKAYNE, BOSTON



GOODLATTE, THE ANATOMY OF PAROSELA SPINOSA

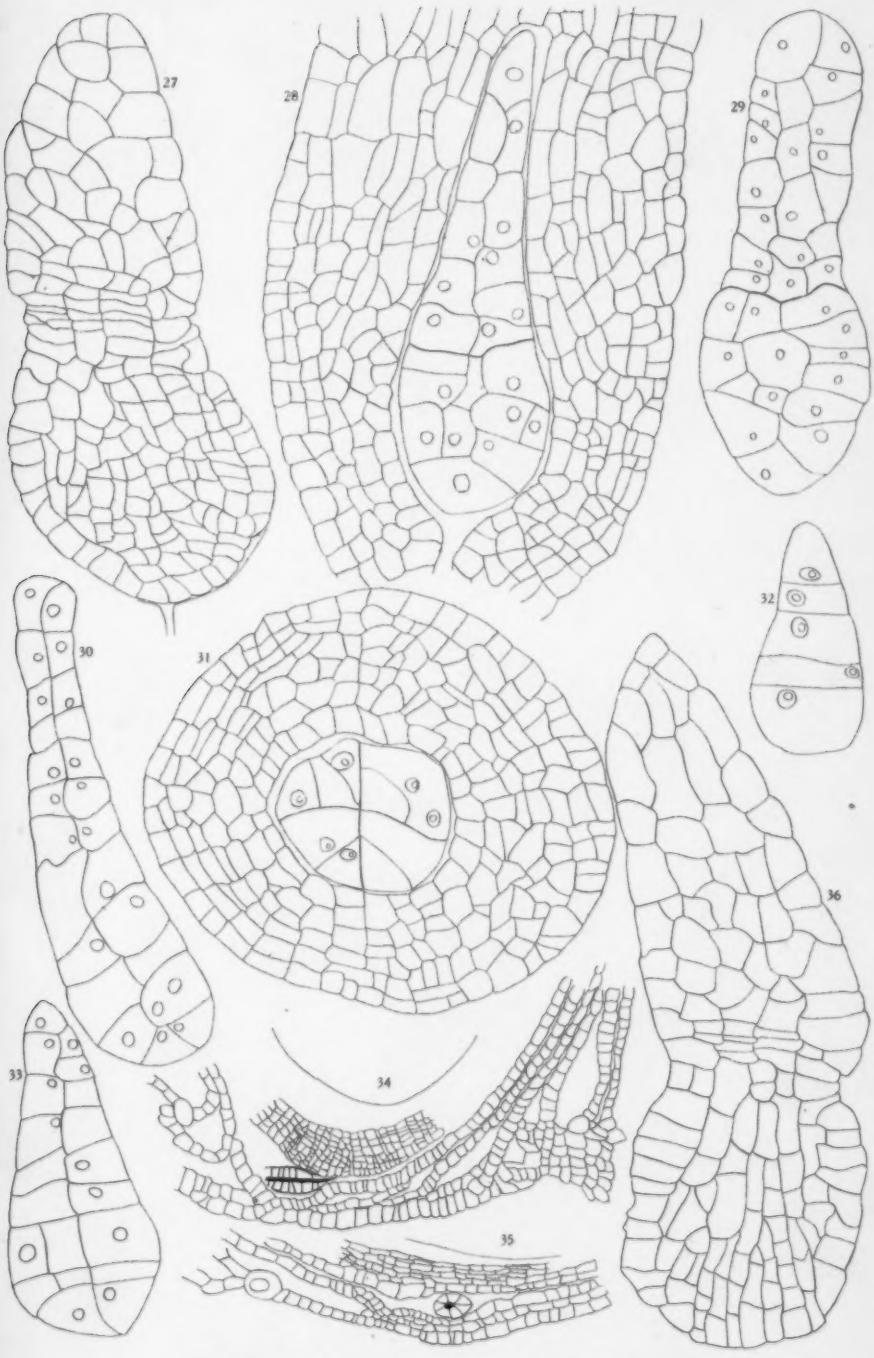
COCKAYNE, BOSTON



GRAHAM, CONOCEPHALUM CONICUM

JOFM

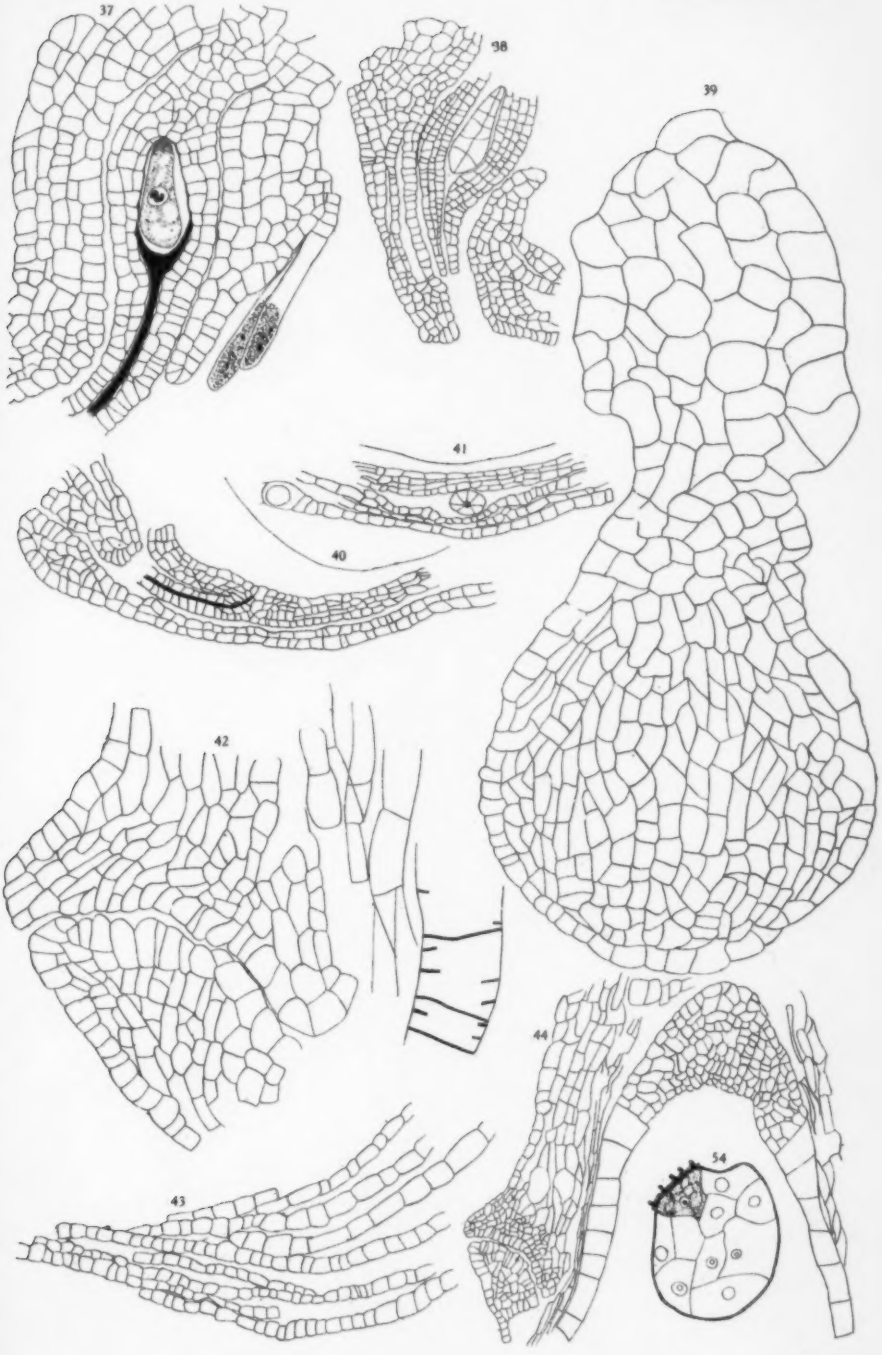
COCKAYNE, BOSTON



GRAHAM, CONOCEPHALUM CONICUM

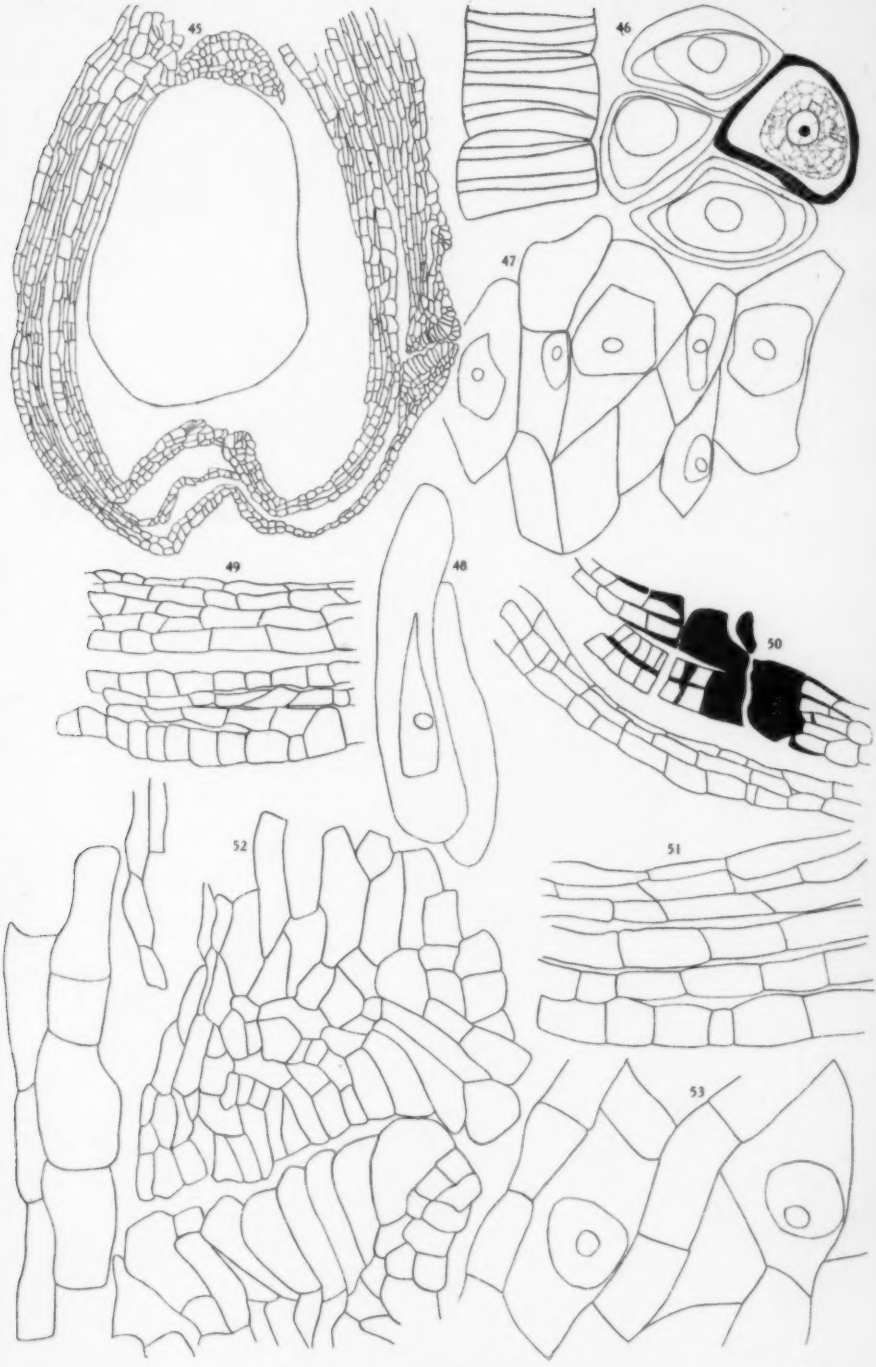
NEW

COCKAYNE, BOSTON



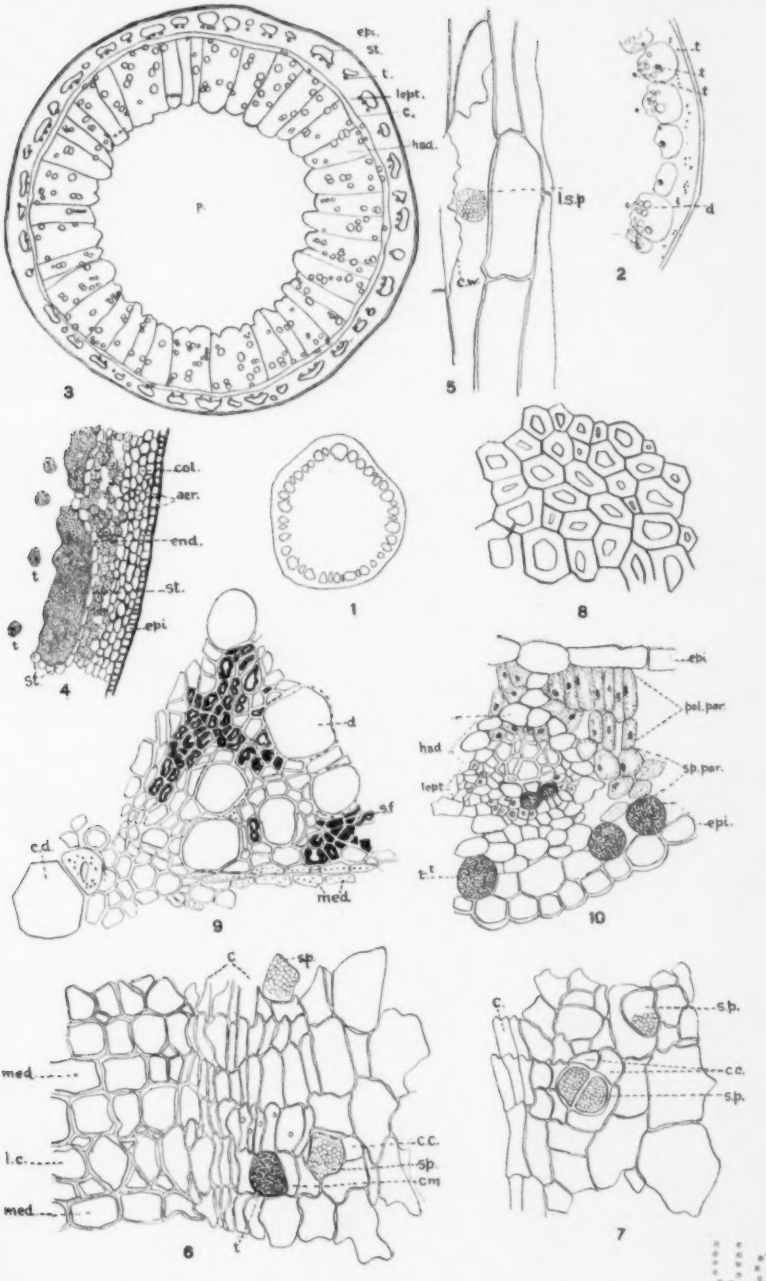
GRAHAM, CONOCEPHALUM CONICUM

COCKAYNE, BOSTON



GRAHAM, CONOCEPHALUM CONICUM

COCKAYNE, BOSTON



STABER, THE ANATOMY OF SESBAN MACROCARPA

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